FACTORY

MANAGEMENT AND MAINTENANCE

JULY 1949

SPECIAL REPORTS

FACTORY's Bear-Down-on-Production-Cost Series

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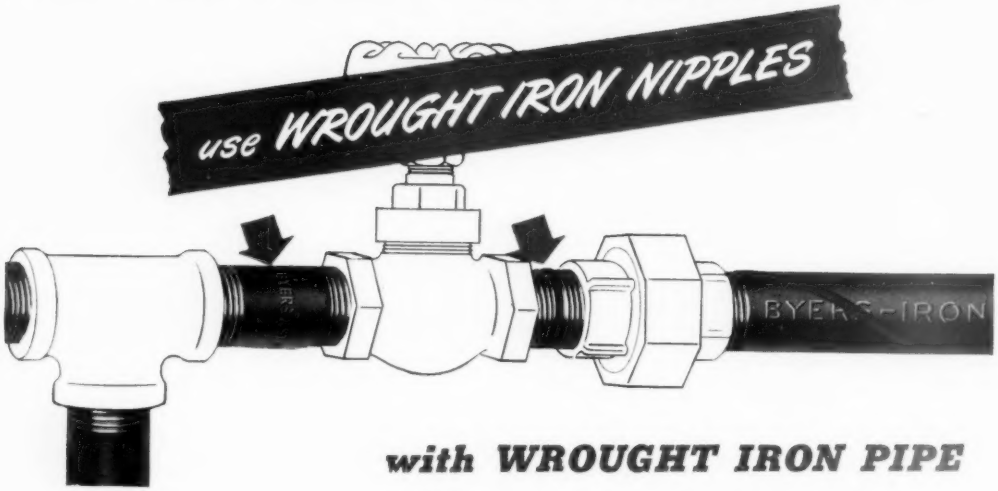
A McGRAW-HILL PUBLICATION

Avoid "Weak Links" in your piping systems—



with WROUGHT IRON PIPE

When you specify wrought iron pipe to lick some corrosion problem, assure 100% protection by specifying that the pipe nipples also must be wrought iron. Neglect of this simple precaution will leave weak spots in your lines, and set the stage for maintenance headaches.

METHOD OF SPECIFICATION

Merely stating that the piping "system" is to be black or galvanized wrought iron is not enough; the use of wrought iron nipples should be specifically designated. This may be done by requiring that the wrought iron nipples shall be made of pipe conforming to the requirements of A.S.T.M. Specification A72-45, Federal Specification WW-P-441a, Navy Specification 44P11k, or any accredited proprietary specification.

WIDE RANGE OF SIZES

Byers Wrought Iron nipples, both standard weight and extra strong, are available in a wide range of sizes and lengths, either black or galvanized. They are manufactured from new, tested, full-weight wrought iron pipe in accordance with the standards established in the specifications of leading technical organizations. All nipples are furnished with right-hand threads unless otherwise specified; nipples with right and left-hand threads are also available. Nipples are furnished "close" or to length as specified.

IDENTIFICATION

The word "Byers" and the weight —either "Std." or "X Stg." are machine stamped around the circumference of Byers Wrought Iron nipples. On close nipples, where it is impractical to stamp on the threads, a red band is used. These markings provide quick, positive identification of Byers Wrought Iron nipples, and help to avoid any danger of accidental substitution of non-durable nipples in the line.

IN WELDED SYSTEMS USE WROUGHT IRON WELDING FITTINGS

Wrought iron welding fittings are available in a wide range of types and sizes from leading fitting manufacturers. Just contact your supplier.

Wrought iron nipples are also available from a number of manufacturers. The identification used on such nipples may be learned by consulting the supplier.

INHERENT CORROSION RESISTANCE

The superior resistance of wrought iron nipples comes from the unique composition and structure of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

The best guide in applying wrought iron is a knowledge of its character and properties. The complete story is presented in the booklet, "The ABC's of Wrought Iron". Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

The iron giant that chews up rocks

A typical example of B. F. Goodrich product improvement

THAT big chunk of iron is a jaw crusher that breaks rocks as big as table tops. Sometimes a parade of these extra-big rocks comes along, makes the jaw chew extra hard for a time. V belts that drove it (shown at the right) used to stretch under this strain, lengthen permanently. Soon they were running off the pulleys. The quarry people came to B. F. Goodrich about it.

B. F. Goodrich engineers had developed a V belt with a new kind of reinforcement called a "grommet." The belt is more elastic, stands sudden shocks and strain.

The new BFG belts were tried on the crusher. They have already lasted far longer, and they pull their load more efficiently. They are still good for years of driving this rock-chewing monster.

This quarry company followed a good procedure which many other companies employ, too. Instead of accepting the high costs of frequent replacement, they called in B. F. Goodrich—and found exactly what they needed to cut costs and keep their plant running with fewer delays. Even if B. F. Goodrich had not had the needed product, the chances are good that they would soon have developed it, for BFG research is constantly at work to meet "impossible" problems and steadily improve even the most standard rubber products. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

B.F.Goodrich
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Now, the time has come when industry can begin to streamline inventories and can place more emphasis on quality. While a few products remain on the critical list, a balance between supply and demand has been reached for most steels. Under these conditions, yesterday's "normal" inventory may loom large and steels of doubtful ancestry may prove a liability.

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MANAGEMENT and MAINTENANCE

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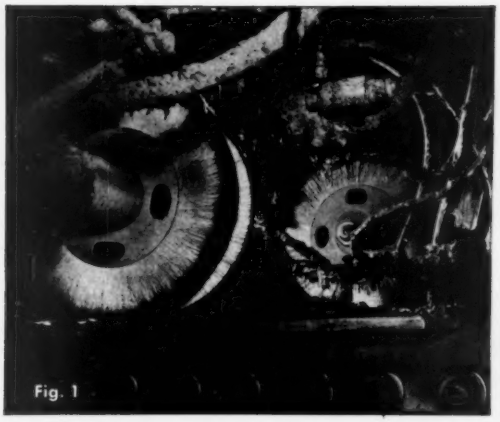
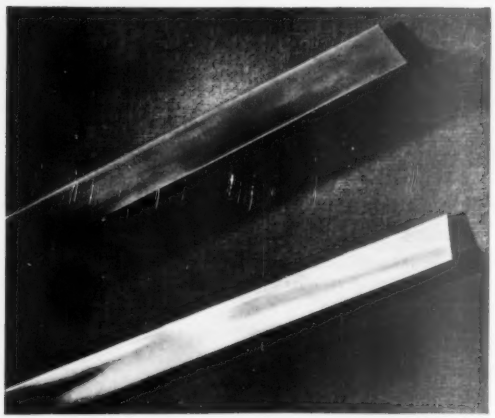


Fig. 1

Fig. 2

HERE'S HOW TO CUT COSTS AND GET A BETTER FINISH ON STAINLESS STEEL



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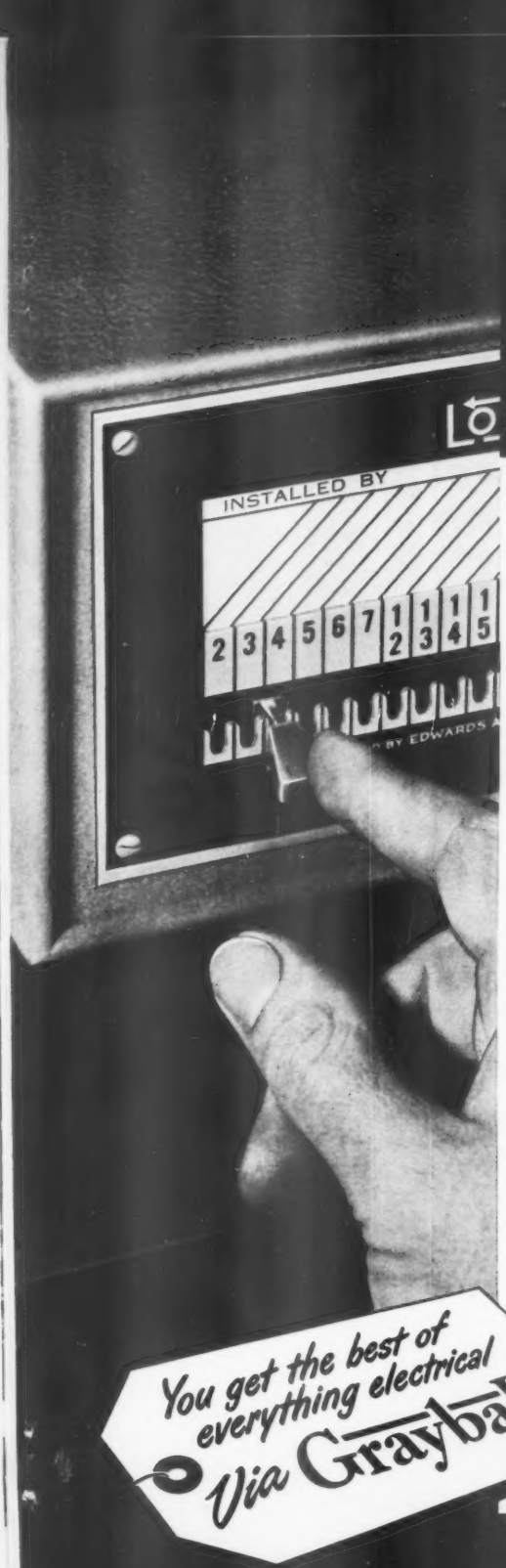

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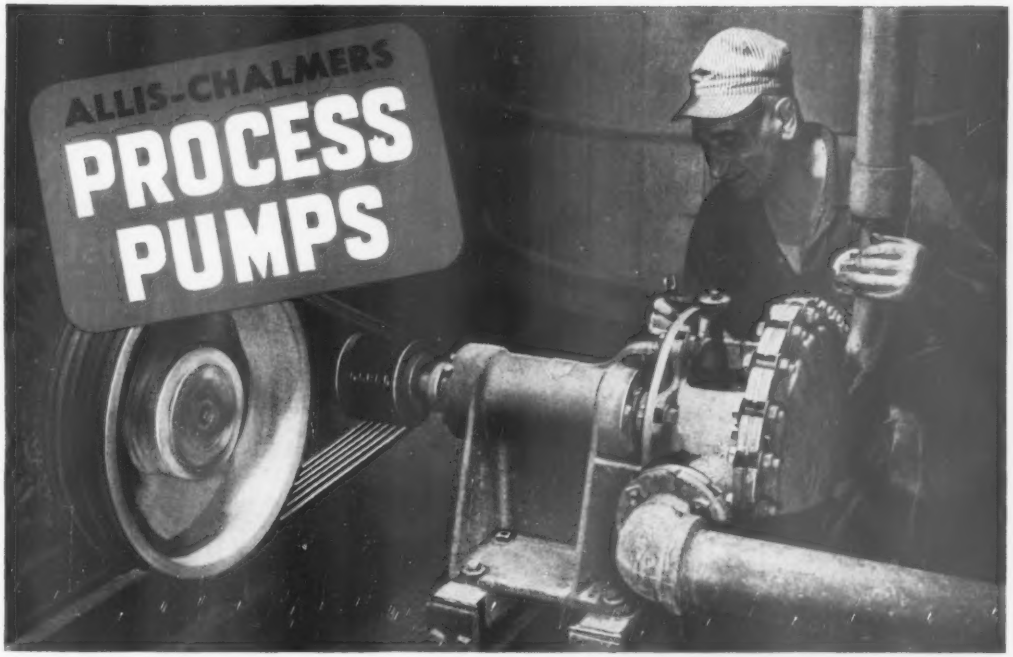

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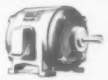

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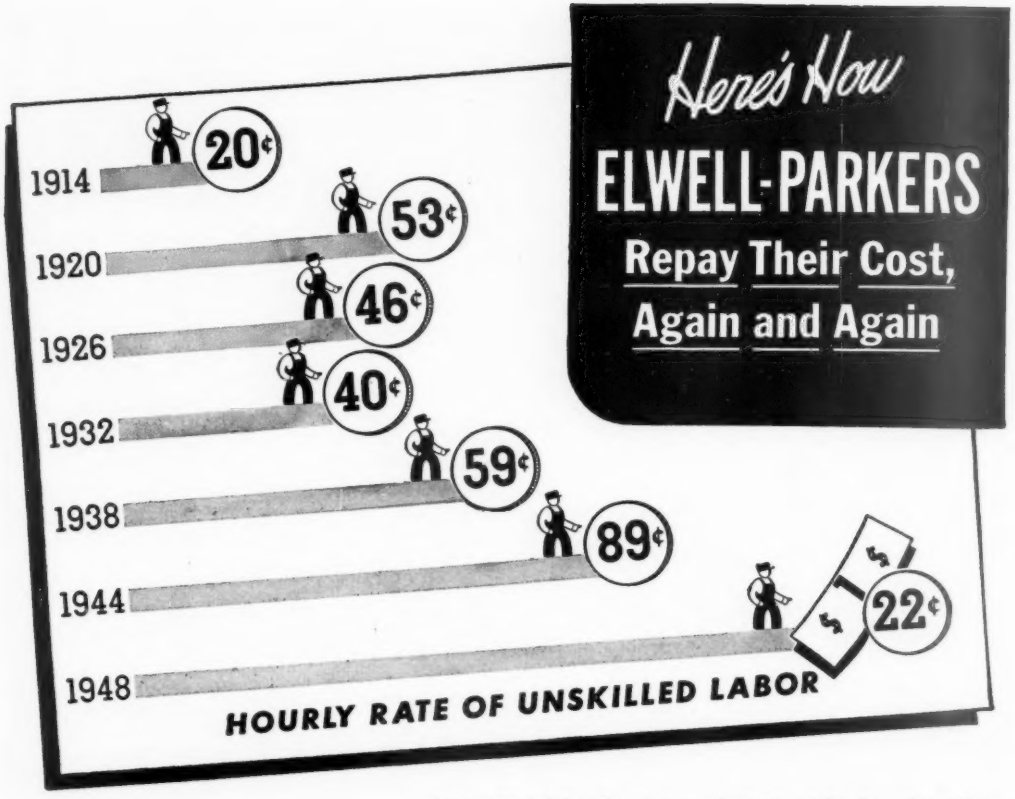

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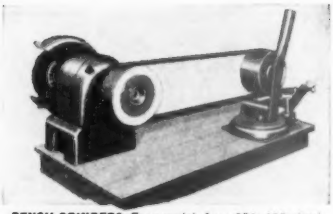

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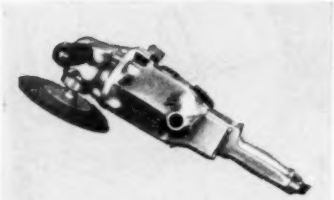

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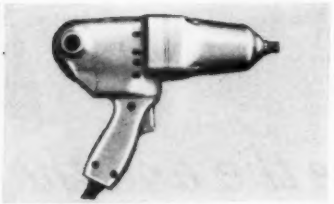

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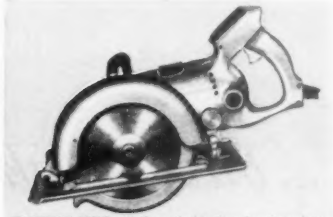

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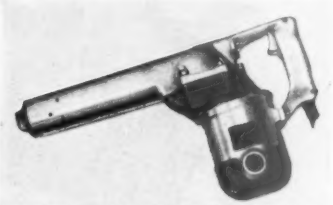
Your first choice for cost-cutting in... Production • Maintenance • Construction!

Drilling, sanding, grinding, screw driving—whatever the job you're doing, there's a powerful Van Dorn Electric Tool to help you do it better, faster, at lower cost! The Tools shown here are just samples of the diversified, versatile Van Dorn Line—over 100 cost-cutting Electric Tools in all! Every one is built of top-quality materials, with modern design and fine workmanship. Your nearby Van Dorn Distributor can give you positive proof of their top-notch performance—show you how plants like yours have used Van Dorn Tools to slash costs all down the line! Call him for sound, experienced help in all your tooling problems!



ELECTRIC HAMMERS: Drive star drills, bull points, chisels, etc.; for drilling, chipping, scaling, demolition, etc. Four models, ½" to 2" hole capacity in concrete.

WRITE TODAY for our illustrated, fact-packed catalog. See where Van Dorn Electric Tools fit into your economy picture. Address: THE VAN DORN ELECTRIC TOOL CO., 719 Joppa Road, Towson 4, Md.

FOR POWER SPECIFY "Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS

At Last! A WIRE ROPE HANDBOOK FOR THE MAN ON THE JOB!

It's new . . . It's different . . . It's easy to understand

J&L STEEL

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3

This 96-page illustrated book is especially written for the machine operator who handles wire rope constantly on his job. And its handy size—4⅜" x 7½"—fits into your pocket, ready for instant reference. It's yours for the asking!

SEND FOR YOUR COPY NOW!

Jones & Laughlin Steel Corporation
407 Jones & Laughlin Building
Pittsburgh 19, Penna.

Gentlemen:

Please send me a free copy of your new handbook "Wire Rope is a Machine."

Name_____

Company_____

Address_____

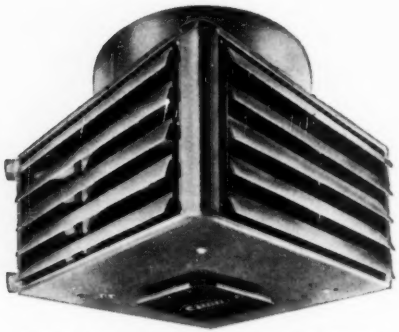
JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

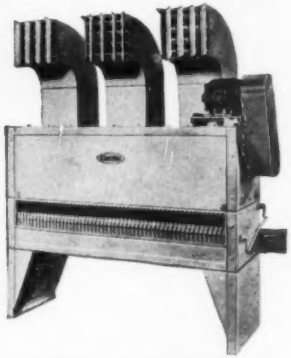
PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

CARRIER 46U HORIZONTAL DISCHARGE UNIT HEATER
New single-row coil construction offers less air resistance and facilitates cleaning. Capacities range from 13,400 to 200,000 Btu's per hour.

CARRIER 48T GAS-FIRED UNIT HEATER
Heat exchanger *and* combustion chamber of Aluminized Steel welded into one leakproof assembly. Capacities range from 70,000 to 230,000 Btu's per hour input.



CARRIER 48S FOUR-WAY DIRECTED-FLO UNIT HEATER
Air discharges from 1, 2, 3 or 4 sides give maximum flexibility in distribution. Capacities range from 49,000 to 500,000 Btu's per hour.



CARRIER 48PQR HEAT DIFFUSER
Note the multiple air discharge outlets with adjustable louvers. Capacities range from 115,000 to 1,570,000 Btu's per hour.

Only Carrier offers this full line of fuel savers

If it's an industrial or commercial space heating installation, choose Carrier Unit Heaters. There is a style, type and size of unit to fit a wide variety of jobs, conditions and fuels — steam, hot water or gas.

Pick the completely new, attractively styled steam or hot water Carrier Horizontal Discharge unit for beauty shops, exclusive stores, and other quality buildings where appearance and quietness count. Sturdy and efficient, too, it is your best heating investment for garages, factories and other industrial spaces.

The Carrier Four-Way Directed-Flo unit (steam or hot water) provides quick heat from relatively high ceiling suspension — directed and controlled in any quantity and at any angle.

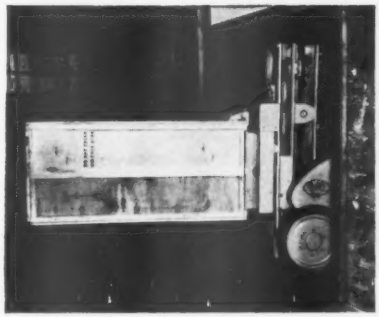
Wherever gas is available, the new Carrier Gas-Fired Unit Heater is the answer to clean, economical heat. Requires no pipes, no ducts, no boilers. For factories, offices, warehouses and other types of buildings.

For ventilating as well as heating large areas, install Carrier Heat Diffusers, either floor, wall or ceiling mounted. Their multiple discharge outlets with adjustable louvers permit air to be delivered in practically any direction.

Field-tested design and high-quality construction are your guarantee of efficient, economical heating with every Carrier Unit Heater. And Carrier's recognized experience and engineering skill are plus values. Carrier Corporation, Syracuse, New York.

Carrier AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

AMAZING NEW SKYLIFT CRATE-CLAMP DEVICE MOVES AND STACKS BULKY CRATES *WITHOUT PALLETS OR FORKS!*



In order to utilize all available space in box cars, the top tiers of crates can be placed horizontally. Clamp attachment is capable of handling in either vertical or horizontal position.

Raising load as he enters car, operator makes sharp right angle turn for positioning of top tier against side of car. As the car is loaded near the doorway, the operator can pull away from the tier immediately without maneuvering, since there are no forks to be withdrawn from beneath the load.

As load is moved into position, side shifting feature of attachment moves load laterally without the necessity of additional maneuvering. Such "jockeying" is often time consuming and, therefore, costly.

SAVES INDUSTRY THOUSANDS OF MAN-HOURS

Cuts loading and unloading Costs More Than Half!

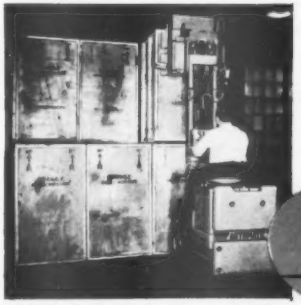
Entirely eliminating the need for forks or pallets in handling large bulky crates, a hydraulic clamp attachment applied to an Automatic Skylift Fork Truck, simply and easily grasps the top, bottom, side or end of crate, securing it firmly for carrying and stacking.

This crate clamp device, with side-shifting feature and push-button control, is an integral unit equipped with separate hydraulic pump and motor, rams, valves, fittings, etc. It is coupled only to the truck's electrical system, and is easily removed to substitute standard forks.

As can be seen by the pictures, this SKYLIFT Fork Truck with clamp is extremely maneuverable, can make sharp right angle turns, easily negotiates steep bridge ramps into box cars, lets operator load car right up to doorway.

The same ease with which operator loads car, is experienced in tiering in storage, as side-shifting feature is utilized to position load accurately.

With the clamp device for handling bulky crates, or in the regular model for moving and stacking any kind of product on pallets, Skylift pays big dividends in money and human energy saved, can cut your handling costs more than half. Mail coupon for complete facts. There is absolutely no obligation.



With a 4" lateral movement either right or left of center, or a total of 8 inches, accurate spotting becomes immediate, and easy, as operator merely pushes the electric control button.

Skylift
ELECTRIC TRUCKS
A PRODUCT OF AUTOMATIC
Lighten LIFE'S LOADS

AUTOMATIC TRANSPORTATION COMPANY
DIV. OF THE YALE AND TOWNE MFG. CO.
39 West 87th Street, Dept. G-9, Chicago 20, Ill.
Please mail me, without cost or obligation, complete facts on your Skylift with Clamp Device, and free catalog.

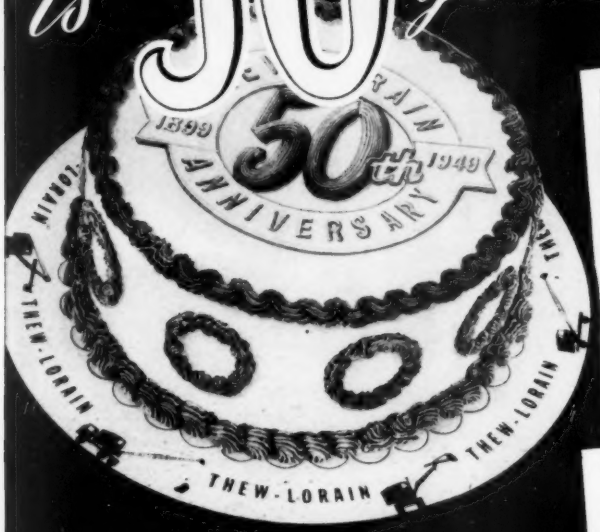
Company Name.....

By.....*Position*.....

Street Address.....

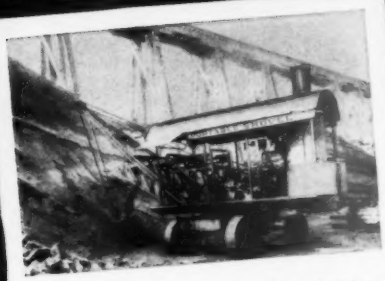
City.....*Zone*.....*State*.....

THEW-LORAIN *is 50 years young!*



50 years ago — July 17, 1899 — an idea became an industry — an industry still going strong today as The Thew Shovel Co. Thew alone hasn't made this anniversary possible. It's due largely to you and your repeated confidence in Thew-Lorain products. We're old only in our years of experience and "know-how" . . . but young as ever in our ideas and efforts to serve you better, today and tomorrow.

THE THEW SHOVEL CO., LORAIN, OHIO



1899 . . . First full revolving shovel as designed and built by Captain Richard Thew in 1875. After 4 years of operation as a private business, The Thew Shovel Co. was incorporated in 1899.

TODAY . . . The world's largest builder of commercial size shovels, cranes, clamshells, draglines and hoes, mounted on crawlers or rubber-tires, is identified by the trademark "Thew-Lorain."

50 YEARS devoted exclusively to the design and manufacture of Power Shovels & Cranes.

THEW Lorain

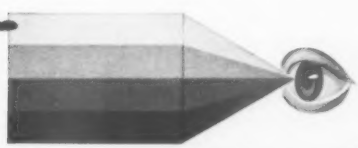
WHAT'S *YOUR* PLANT'S EYE-Q?

A High "Eye-Q" is the Cue to High Production . . .

Now, in hundreds of plants, old and new, Truscon Eye-Comfort Color Harmony systems are helping to set new standards of worker efficiency, contentment and safety. The wartime research of the great Libbey-Owens-Ford Glass Company in combating worker eyestrain resulted in the development and standardization of the "day light" principle of maintenance painting in all of their plants. The illustration above shows a typical result in one of their plants. They have already completed a half-million dollar program of interior maintenance painting, employing the "day light" principle.

YOUR regular maintenance painting can now be made beneficial, far beyond the original purposes of decoration, cleanliness and preservation. Today, with the scientifically correct Eye-Comfort Color Harmony systems developed by Truscon, you can banish eye-fatigue, have restful visual variation. You at once improve worker morale, increase worker efficiency, lower accident potential. You gain these benefits because your plant is then equipped to treat the human eye as nature treats it—kindly. Truscon specialists are at your service to discuss the Color Harmony system most appropriate for your plant and its processes. Extensive literature on the subject is available—write to Dept. EC-7, *Truscon Laboratories, Division of Devoe & Raynolds Co., Inc., Detroit 11, Michigan.*

Eye-Comfort
COLOR HARMONY
DAY LIGHT • COOL LIGHT • WARM LIGHT • SOFT LIGHT

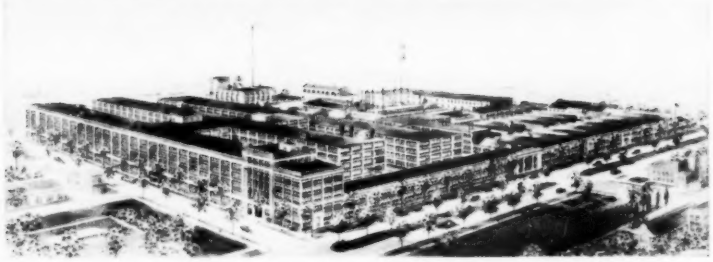


TRUSCON *laboratories*

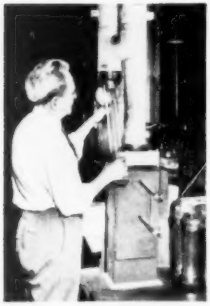
GROVER

PNEUMATIC TUBE SYSTEMS

Save Time and Money In Many Modern Plants



BURROUGHS ADDING MACHINE COMPANY SPEEDS UP STOCKROOM TO ASSEMBLY LINE DELIVERY OF PARTS WITH GROVER SYSTEM



Special Grover Carrier as Well as Tube System Developed for Burroughs' Individual Needs

Ten minutes it used to take—by messenger! Four *seconds* it takes now by Grover Pneumatic Tube! Think of it—a hundred and fiftieth of the previous time. But Burroughs, making assemblies of as many as three different types of product on a single assembly line for one day, wasn't content to take those ten-minute time lags and do nothing about it. Burroughs men plus Grover men decisively licked this problem. Final assembly, sub-assembly and stockroom are now Grover-linked at Burroughs. Requisitions flash one way—parts flash back in quick response in specially developed carriers. Time is saved, the potential of human error in such transactions is now practically nil. Have *you* a special problem? Grover representatives are at your service, no charge, no obligation. May we send you a copy of our latest Factory Bulletin?

GROVER has a special Factory Bulletin of interest to plant traffic and production personnel. Write *Grover Company, 25519 W. Eight Mile Road, Detroit 19, Michigan.*

GROVER

PNEUMATIC TUBE SYSTEMS LITERALLY GIVE WINGS TO PAPER WORK, MONEY, SMALL PARTS, SAMPLES

Man or boy messenger service is not adequate to fit in with the tempo of present day industrial production. Uncertainty, human error, slowness—these factors can all be ruled out by planning on GROVER equipment to do the messenger job quickly, tirelessly, without error.

ELIMINATES ERRORS, DELAYS, HIGH COST OF MESSENGER SERVICE

Central control by trained personnel is a major factor in the stepped-up plant efficiency secured with a GROVER installation. Quietly and speedily inter-departmental communication and transmittal go on. In chemical sampling analysis, in production line delivery of small parts, in all paper work transmission, there's a degree of efficiency achieved that management needs.

GROVER

• *PNEUMATIC TUBE SYSTEMS* •

THE GROVER COMPANY • DETROIT 19, MICHIGAN

Offices in Principal Cities

Boat-builders launch DOUBLE PROFITS... *both in production and sales*

. . . when AMERICAN PHILLIPS SCREWS "come aboard"

SMOOTH SAILING IN PRODUCTION: Boats almost build themselves . . . with the handling ease, driving speed, and non-slash protection of American Phillips Screws. Every fastening is clean and shipshape . . . *turned up flush, to stay.* And every American Phillips fastening *takes only half as long* as an old-fashioned slotted screw. So costs are really keelhauled!

SMOOTH SAILING IN SALES: From boats to bamboo bars, the American Phillips universal cross-recess enables manufacturers to put new decorative values, new sales appeal into their products. For American Phillips fastenings say "Modern Quality" so plainly that many manufacturers find it mighty good business to merchandise: "American Phillips Construction." How about *you?*

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Building

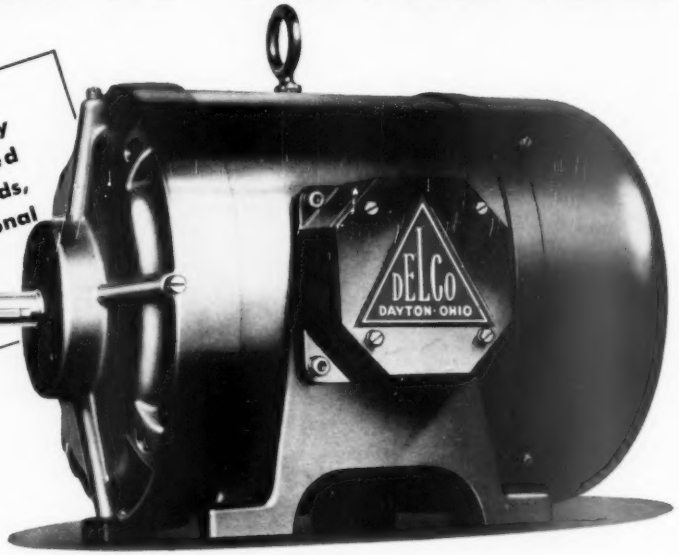
AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

DELCO MOTORS

STAND UP TO THE JOB

There is a Delco totally enclosed fan-cooled motor to fit your needs, in sizes from fractional ratings to 75 h.p.



Here at the factory, Delco motors are rated in terms of horsepower. In the field of industry, we are proud to say, they are rated *tops*. Large or small, every Delco motor is built to carry its rated load and to keep on carrying it even under the most adverse conditions. When you count on Delco motors for power, you don't have to count on down-time.

Delco's ability to deliver continuous, trouble-free power is due to special construction and design features—such as positioned bearings, Delcote coil insulation, corrosive-resistant cast iron frame, positive lubrication, dynamically balanced rotor and shaft assembly, water-tight conduit box.

For complete data on Delco Motors, address Delco Products, Dayton, Ohio, or our nearest sales office.

DELCO PRODUCTS DAYTON OHIO

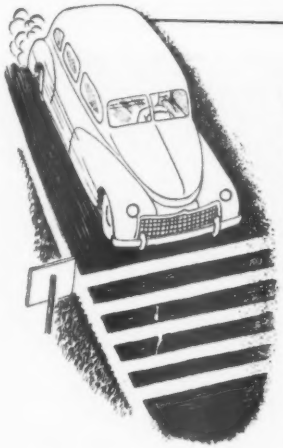
DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

Good, Better, Best

—which is which by Test!



The Hit-the-Road Test

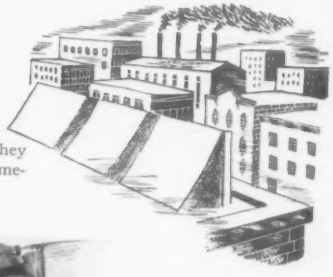
It's a good sign to drive along a turnpike and see a series of white stripes painted across the road. It means the state is on the job. Its public officials are testing the endurance of different paints to determine the best for marking traffic lanes.

The Half-a-Head Test

It's a horrible way to treat a poor innocent girl. But it's big business . . . *important* business. To compare the effectiveness of different shampoos they split a girl's head in halves (figuratively, of course) and do one side with one shampoo, the other side with another.

The Hoboken Test

One of the most prominent laboratories in America tested dyed fabrics by hanging them *for one year* on a roof in Hoboken, N. J. We wondered why they picked Hoboken. They said there was something in the air.



The Dollars-and-Sense Test

It takes good common sense to save important dollars on industrial painting jobs. That is why it's wise to test paints before final specification. After all, it isn't the cost per gallon that counts. It's the *amount* of paint required and the *time and labor* involved that govern the cost of the job. So test. Compare. Yes, compare *by performance* a gallon of any other good paint with a gallon of Barreled Sunlight. See how much more yardage Barreled Sunlight gives you. Clock how much faster Barreled Sunlight goes on. Notice how much whiter, cleaner, more solid Barreled Sunlight looks after drying. You'll be convinced, once and for all, that Barreled Sunlight is the paint that makes sense and saves dollars. It tops any other paint on the market.

Want proof? Write, and a Barreled Sunlight representative will call on you soon.

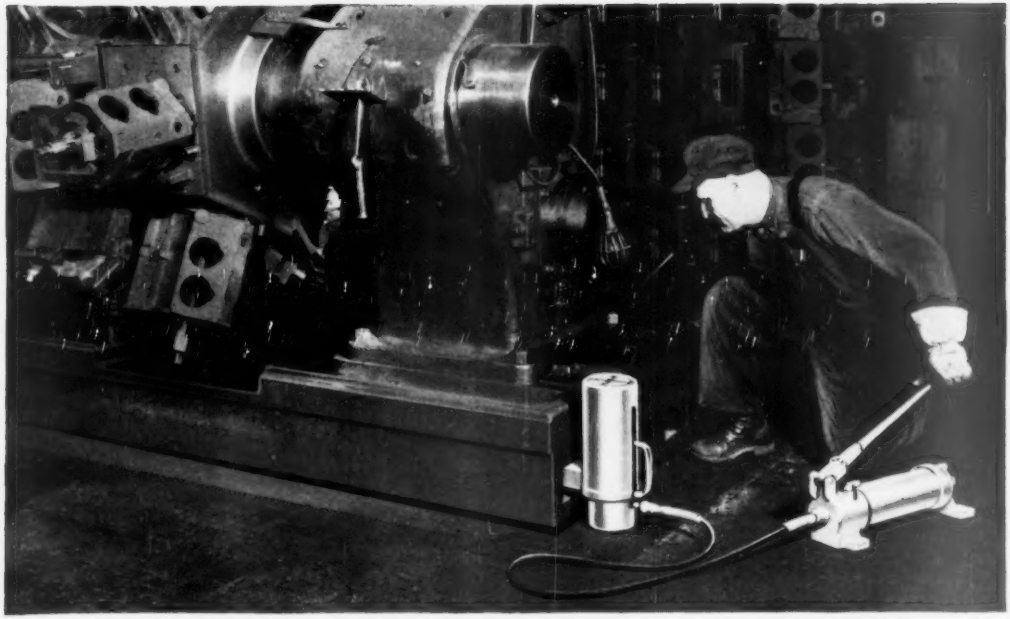
U. S. GUTTA PERCHA PAINT COMPANY
2-G Dudley Street, Providence, Rhode Island

Barreled Sunlight

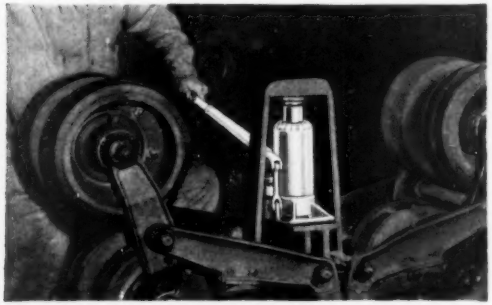
Paints

In whitest white or clean, clear, pleasing colors, there's a Barreled Sunlight Paint for every job

PROFIT-MAKING SHOP IDEAS by BLACKHAWK®



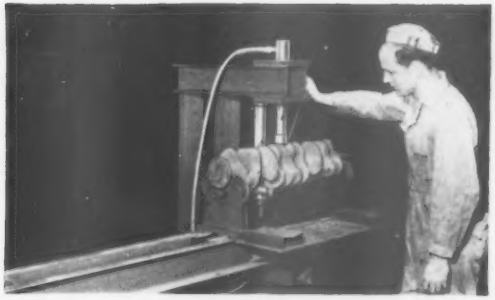
1 LIFT A 25-TON LOAD FROM A LOW HEIGHT OF ONLY 2¼ INCHES! That's only one of the many work-saving jobs performed by Blackhawk's largest Porto-Power. The basic unit includes a 50-ton all-directional ram. And a toe-lift sleeve can slip over the ram — as above. The toe-lift setup is widely used for moving transformers and heavy machinery. This attractively-priced Porto-Power (Model S-80) can also be adapted to gear pulling and service in shop-built presses.



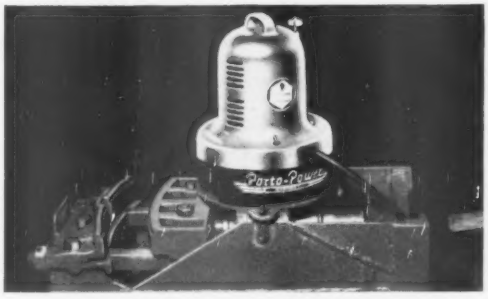
2 A LOW-COST, VERSATILE POWER UNIT, for exerting tons of pressure in shop work, is a Blackhawk Hydraulic Hand Jack. Exclusive design permits use at full power in horizontal positions. 1½ to 100-ton capacities.

3 A FLASH OF LIGHT from Blackhawk's "Torkflash" Tension Wrench tells when a nut is pulled down to proper tension. Quickly pays for itself on assembly jobs by preventing bolt damage and improving performance.

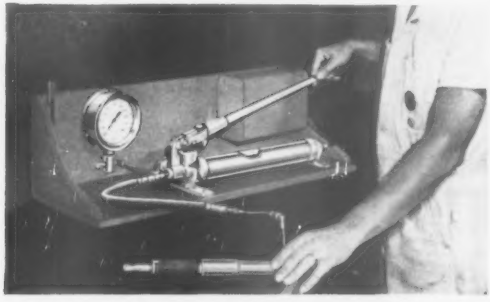
4 **"FREE WHEELING" RATCHETS** — an exclusive Blackhawk design — assures *complete utility with every swing.* No teeth — it reverses instantly — does not skip. Blackhawk makes industry's finest wrenches. Yet, they are generally priced lower than ordinary quality wrenches.



5 **INEXPENSIVE HOME-MADE PRESSES,** using Porto-Power hydraulic units, answer many special problems. Remotely-controlled, all-directional Blackhawk power units are easily mounted. Ram sizes are available for 2, 4, 7, 10, 20, or 50 tons of power.

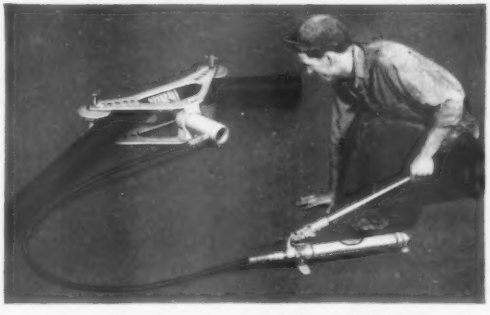


6 **MOTORIZE HAND-OPERATED HYDRAULIC DEVICES** — The Porto-Power unit on this rail bender is an *electrically-driven hydraulic pump.* Motor, valves, reservoir and pump are all in *one unit.* Develops up to 10,000 p.s.i.



7 **TEST INTERNAL PRESSURE CAPACITIES**—up to 10,000 p.s.i. A standard Porto-Power hand pump can inject oil under high pressure into vessels, valves, etc. The gauge measures pressures exerted in test objects.

....Use These SHORT CUTS Throughout Production, Maintenance, Engineering



8 **THIS PIPE BENDER ALSO WORKS WHEN THERE'S NO PIPE TO BEND** — A Blackhawk pipe bender is the "sensible buy" because its Porto-Power unit can be used separately as a versatile, all-directional hydraulic jack.

No matter what your position is, chances are strong that the Blackhawk line holds a *good idea* for you. Blackhawk specializes in building low-cost, wide-utility, portable equipment. It's time well spent to look over the many money-saving suggestions in Blackhawk catalogs. See your Blackhawk Industrial Supply salesman or write Blackhawk.

BLACKHAWK MFG. CO., Dept. M-2779, Milwaukee 1, Wis.

For Time-Saving Hydraulic Equipment and Wrenches, Always Specify

BLACKHAWK®

HYDRAULIC HAND JACKS, 1½ to 100 tons. HYDRAULIC WHEELED JACKS, 1½ to 4 tons. HYDRAULIC REMOTELY-CONTROLLED "PORTO-POWER" ® JACKS AND ATTACHMENTS, 2 to 50 tons. WRENCHES — all practical sizes and socket drives. TORQUE INDICATORS — up to 1000 ft. lbs.

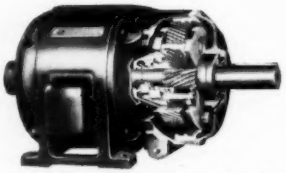
Buy TRI CLAD Gear Motors

REG. U.S. PAT. OFF.

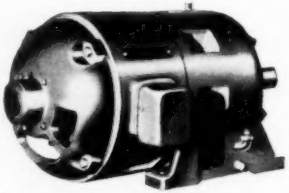
when? . . . . . NOW!

how? . . . FROM STOCK!

9 strategic locations throughout the country assure you of Fast Delivery



Single-reduction unit, speeds down to 155 rpm.



Double-reduction unit, speeds down to 13.5 rpm.

Most popular Tri-Clad gear-motor ratings, from 1 to 15 hp, are available right off warehouse shelves.

Look at what you get—the industry proved Tri-Clad induction motor for low-speed drives. Extra load carrying capacity in a smaller space than conventional gears because General Electric's planetary gear system gives you an additional 1:1 ratio of reduction. You get easier mounting in a smaller space, more motor protection with Tri-Clad gear-motors.

You'll find that standard G-E gear-motors fill the bill for most low-speed drives. Where special requirements must be met, G-E engineers can build you a gear-motor engineered to your specifications.

Call your nearest General Electric sales office—or General Electric Distributor now for FAST SERVICE on all your gear-motor requirements. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

700-1

KAYLO®

Insulating Roof Tile goes to work

IN THIS new roof, as in every roof of Kaylo Insulating Roof Tile, there's a unique new combination of advantages.

Kaylo Roof Tile is a structural material that combines thermal insulation and structural strength. Its insulation value equals that of an inch and a half of standard insulating board.

It is also lightweight (less than 6 pounds per square foot). This means less steel in construction and easy handling of the tile.

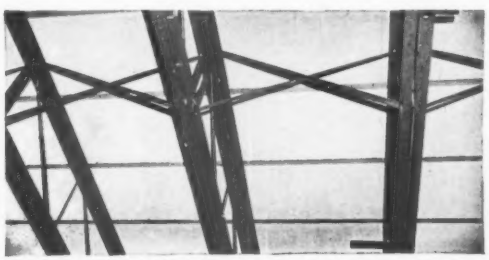
Kaylo Roof Tile does not burn. The tile itself withstands building fire temperatures (as defined by the standard A.S.T.M. fire curve) for more than one hour without permitting a temperature rise on the cold side great enough to constitute failure. Send the coupon today for complete data.

Kaylo Roof Tile can be laid on properly spaced standard structural shapes, or on rail-type sub-purlins attached to purlins, as shown.

Ease of handling is seen here, as lightweight Kaylo Roof Tile is slipped into place on sub-purlins.

With ordinary power or hand tools, Kaylo Roof Tile can be cut on the job to fit around skylights, stacks or other constructions extending through the roof.

Final step is the simple task of applying standard built-up roofing. Building a Kaylo Roof Deck is remarkably easy, all the way.



Underside of Kaylo Roof Deck forms a completed ceiling, without treatment or painting. It reflects light, raises illumination levels, as shown above. Trusses shown span 64' 5" on 5' 0" centers.

SEND COUPON FOR FACTS

AMERICAN STRUCTURAL PRODUCTS COMPANY
Dept. F-416, P.O. Box 1035
Toledo 1, Ohio
Gentlemen:
Please send, without obligation:
☐ Illustrated booklet, "Kaylo Insulating Roof Tile"
☐ Free sample of Kaylo Roof Tile
☐ Have representative call

Name_____
Address_____
City_____ **County**_____ **State**_____

Announcing BULLDOG Push-Button

Pushmatic, key to Electri-Center, gives push-button control at the touch of a finger or complete circuit protection at the hint of an overload. Approved by Underwriters' Laboratories.

SIMPLE, compact, attractive . . . the *Pushmatic* Narrow Column Panel, featuring *Pushmatic*, offers versatility and adaptability never before obtainable in any panelboard.

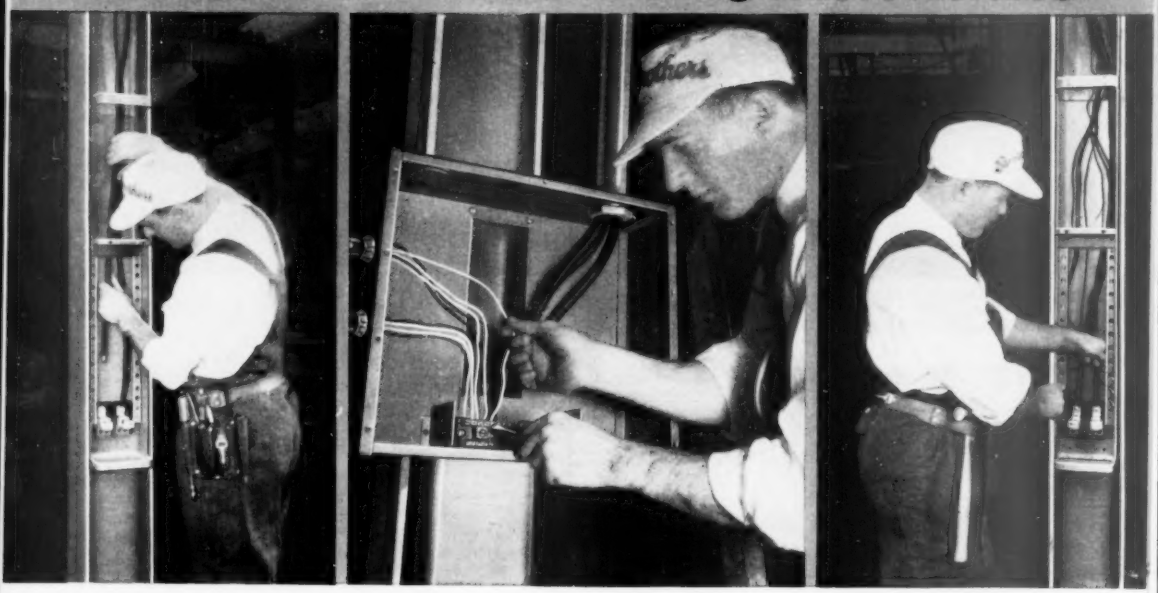
You'll be surprised at the ease of installation and operation made possible by the use of simple, compact *Pushmatic* circuit-breaker units.

And it's easy to wire! Installation time is cut to a minimum. The wireman pulls the heavy main cables and branch circuit wires into place in the cabinet before the panel is mounted. He works quickly and surely because there is nothing to block his vision or cramp his movements.

There are four types of *Pushmatics:* THERMAL ONLY, THERMAL-MAGNETIC, or either of these types with AMBIENT COMPENSATING FEATURES. All *Pushmatics*, regardless of rating or type, are identical in size and contour and are interchangeable. Narrow Column Panels can be ordered with any combination of *Pushmatic* types or ratings. Ratings: 15 A. to 50 A. 120/240 V. AC.

The actual installation, pictured below, could have been done just as easily and quickly in your own plant. Send the coupon today for *Pushmatic* Bulletin #493. It will answer all your questions about prices and specifications.

WIRING IS QUICKER AND EASIER WITH THE *Pushmatic*



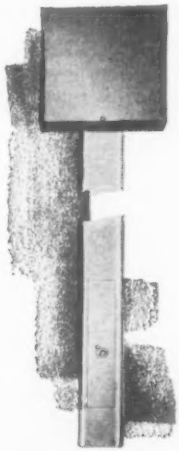
1 **After installing** the light rear halves of the cabinet and riser section, the wireman pulls the main cables down and connects them to the main lugs, easily and quickly.

2 **He makes** his neutral connections in the Pull Box near the ceiling, saving the conduit and wire he would have used had they been made in the panel below.

3 **In plain** view he brings the branch circuit wires down into the cabinet, pulls them through the holes in the wire retainer and skins them ready for connection to branch *Pushmatics*.

"Pushmatic" NARROW COLUMN ELECTRI-CENTER

Control with Automatic Protection



Positive finger-tip control and automatic protection against short or overload are yours in the sensational, new *Pushmatic*.

Just a push of the finger makes or breaks the circuit. No resetting manually when the circuit is broken by short or overload. Just PUSH—and the electric service is restored.

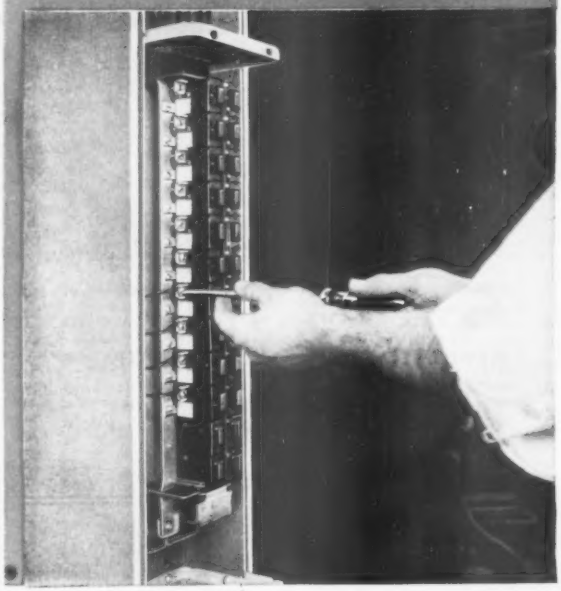
Smaller than a pack of cigarettes, the *Pushmatic* is the most versatile and flexible unit available today.

Pushmatic is an individual single pole unit, eliminating complicated group mountings and making additions and changes a simple matter. And this smooth-operating unit is built for long life. Metal to plastic bearing surfaces prevent corrosion and sticking.

Send the coupon today for descriptive *Pushmatic* Bulletin #493 for complete information about the revolutionary, new *Pushmatic*. Learn how it makes the Narrow Column Panel the most versatile and adaptable panelboard available today.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

NARROW COLUMN PANEL



4 The light cabinet interior is then set in place in front of the wires and cables. Having already aligned the branch wires with the *Pushmatic* breakers through the wire retainer, he simply inserts the wires in the solderless wire grips and tightens the pressure screws.

PUSH
It's ON

PUSH
It's OFF

PUSH
It's ON again

BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

BULLDOG ELECTRIC PRODUCTS COMPANY
Detroit 32, Michigan

Please send me *Pushmatic* Bulletin #493 giving full information and prices o
your *Pushmatic* Electri-Centers.

Name _____

Company _____

Street Address _____ Zone _____

City and State _____

Enduro-THRIFTY METAL OF 10,000 USES

JET ENGINES – with their various components of stainless steel furnish an outstanding example of the heat-resistance of Republic ENDURO. From combustion chambers to exhaust nozzle, stainless steel holds tight rein on the hurricane of searing exhaust gases which otherwise could easily melt the entire plane structure.

AND SPEAKING OF HEAT-RESISTANCE . . .

The ability of Republic ENDURO Stainless Steel to maintain its exceptionally high strength in the blistering heat of a jet combustion chamber is but one of the many reasons why this versatile metal is being used throughout industry for an ever-increasing number of high temperature applications—from annealing boxes and furnaces to retorts and vapor condensers.

High corrosion-resistance, ability to withstand rough usage and abuse, fatigue-resistance . . . all are important ENDURO advantages. But one of the most important of all is ENDURO'S unusually high strength-to-weight ratio . . . permitting the use of thin, lightweight structural sections . . . efficiency without either excessive bulk or weight.

Whether you are designing a *product of tomorrow* or further improving or refining your present product or products, keep ALL of the advantages of ENDURO Stainless Steel in mind. For additional information or specific technical data, write today to:

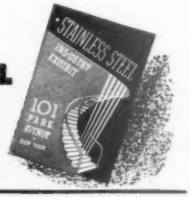
REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Enduro **STAINLESS STEEL**

REG. U. S. PAT. OFF.

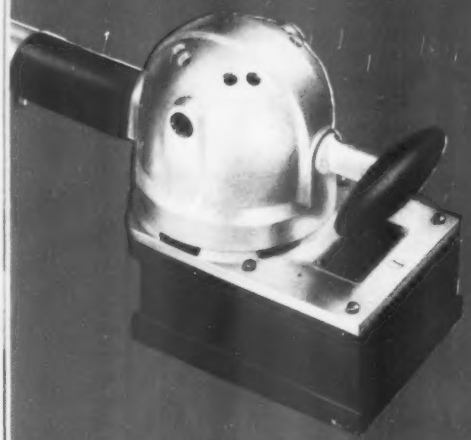
REPUBLIC STEEL

✓ ***Check ALL 12 advantages:*** • RUST AND CORROSION-RESISTANCE • HEAT-RESISTANCE • HIGH MELTING POINT • LOW COEFFICIENT OF EXPANSION • HIGH STRENGTH • GOOD DIMENSIONAL STABILITY • NO METALLIC CONTAMINATION • EASY TO CLEAN • EASY TO FABRICATE • EYE APPEAL • LONG LIFE • LOW END COST



Start finishing profitably . . . get SKIL Sanders

SKIL Belt Sander


SKIL Oscillating Sander

Are your finishing operations as profitable as your other manufacturing processes? They *can* be...if you use time-saving, money-saving SKIL Belt Sanders and SKIL Oscillating Sanders.

Put these hard-working tools on the job in your plant now. They'll sand down surfaces *faster* . . . and cut down costs *further*. In addition to sanding, they'll buff, polish and rub wood, metal, plastics and compositions . . . and pay for themselves in savings everywhere. Ask your SKIL Tool Distributor for a demonstration.

SKIL Tools are made only by

SKIL ELECTRIC Tools PNEUMATIC

SKILSAW, INC.
5033 Elston Ave., Chicago 30, Ill.
Factory Branches in Principal Cities
In Canada: SKILTOOLS, LTD.,
66 Portland St., Toronto, Ont.

SKIL Oscillating Sander

SKIL Oscillating Sander provides *fastest*-cutting and *smoothest* surfacing in a single operation. Exclusive compound action drives front edge with a circular motion...and trailing edge back and forth.

SKIL Oscillating Sander

SKIL Oscillating Sander safely finishes right into corners where other sanders won't reach. Double-size, super-power motor. Unique method of attachment saves 25-30% on abrasive paper. Perfect for rubbing down undercoater and between finishes.

SKIL Belt Sander

SKIL Belt Sanders lead the field at any finish. Powerful cool-running motors drive belts at right speeds to give smooth, ripple-free surfaces faster. Perfectly balanced, easy to handle, efficient, economical. The ideal sander for polishing brass, bronze and aluminum sheets.

SKIL Belt Sander

SKIL Belt Sanders provide highest sanding speed (10 times faster than by hand) yet give flat surfaces a hand-sanded finish. Ideal for preparing surfaces for painting, varnishing or lacquering. Makes quick, easy work of removing old finishes.

Pittsburgh CARGOTAINERS

Speed Operations and Reduce Handling Costs

Above, CARGOTAINER being loaded into delivery truck at vendors holds 345 castings—more than 2700 lbs. Previously only 88 castings weighing 704 lbs. were handled in odd size drums by one man in the same amount of time. Uniform size of CARGOTAINERS allows easy stacking after castings are loaded—also affords more efficient handling from inspection through shipping.

CARGOTAINERS in above photograph are received at assembly plant from vendor—are easily unloaded directly from truck to storage space. Note ease of stacking and minimum of storage space required, also the variety of parts that pack easily in CARGOTAINERS.

At right, CARGOTAINERS again save additional handling time and costs at end of machining process on castings. Parts are easily packed back into CARGOTAINERS and moved to storage to await final assembly. The awkward gap between vendor and assembly plant is easily bridged with versatile, maneuverable CARGOTAINERS.

For further information on Pittsburgh CARGOTAINERS, write Pittsburgh Steel Products Company, Department F, Grant Building, Pittsburgh 30, Pa.

CARGOTAINERS illustrated are in operation at both Pittsburgh DuBois Division and Monessen Foundry Division, Rockwell Manufacturing Company.

CARGOTAINERS by Pittsburgh Steel Products Company
Subsidiary of
Pittsburgh Steel Company

Kimpak* Float Packaging

Cuts shipping costs— reduces damage in transit!

KIMPAK creped wadding gives your product better protection, yet saves you money, too! It's strong—to guard the most delicate articles; flexible—to adapt to any product; soft, clean and smooth—to provide the surest protection for finished surfaces! Yes, damage enroute is remarkably reduced with such safe, dependable protection!

KIMPAK reduces handling costs, because it's so easy to apply and pleasant to handle. And nothing else can equal the eye-appealing neatness of a KIMPAK wrapped product! Investigate now the many advantages of this newer, better packaging material. There's a specification to meet every requirement of the four basic methods of Interior Packaging . . . Surface Protection, Flotation Packaging, Blocking and Bracing, and Absorbent Packaging. For free booklet, send in coupon below.

1. Sheet of Kraft-backed KIMPAK is laid over top of cabinet and down sides.

2. Corrugated container is pulled down over KIMPAK-protected cabinet finish.

3. Assembly is up-ended, and container closed tightly at bottom over wood base frame protecting legs of cabinet.

4. Completed shipping package now provides full surface protection for the cabinet from container wall contact.

All photographs courtesy of Zenith Radio Corporation, Chicago, Ill.

Kimpak
REG. U.S. PAT. OFF. & FOREIGN COUNTRIES

A PRODUCT OF Kimberly Clark RESEARCH

CREPED WADDING

*T. M. REG. U. S. & CAN. PAT. OFF.

FREE BOOKLET

KIMBERLY-CLARK CORPORATION FMM-749
Neenah, Wisconsin

Please send me free, the illustrated KIMPAK packaging guide.

Name .....

Firm .....

Address .....

City ..... *Zone* ..... *State* .....

"During a power phase failure not one motor out of over 100 failed to clear itself... When power was restored we were ready to operate without a moment's loss in production"

"We believe you will be interested to know how well your Fusetron dual-element fuses protected our electric motors when we experienced a phase failure on our power circuit this past week.

"We have considerable obsolete 2 phase equipment in our plant but we are eliminating it as we go along. To protect these motors until the change-over, we had two choices: expensive thermal relays or Fusetron fuses. Naturally, we chose Fusetron fuses. From that time on, which is over two years, we have not lost one motor. Last week when the power phase failure occurred, not one motor failed to clear itself.

"Having over a hundred motors in the plant, we had a hatfull of blown fuses to replace but, when the power was restored, we were ready to operate without a moment's loss in production.

"Our past experience with Fusetron fuses proves that they will not blow needlessly — provided, of course, that the fuse rating is matched to the motor.

"We are using Fusetron fuses on our new machinery along with thermal protectors to prevent the machine operators from blocking the relay switches in the on position.

"Fusetron fuses are an absolute must on all electrical equipment in our plant."

Victor J. Kryst, *Maintenance Foreman,*
F. H. HILL COMPANY, INC.,
Cleveland, Ohio

Our Experience Proves

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Fusetron DUAL-ELEMENT Fuses

Provide

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Get all the Facts - Send the Coupon Now!

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

Address _____

City & Zone _____ *State* _____ 749

Foundry Production Operations at
HUNT-SPILLER MANUFACTURING CORPORATION
Emphasize Economy of GAS

EFFICIENT UTILIZATION of GAS in four modern ovens resulted in a 50% saving in fuel cost when compared with previous core-baking methods at Hunt-Spiller's foundries.

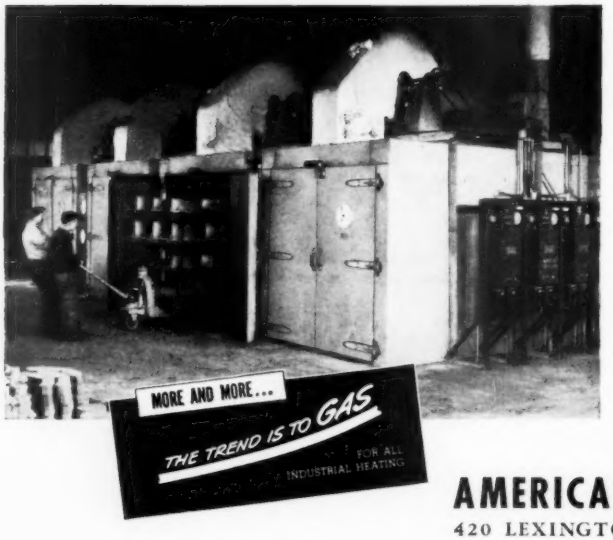
This pioneer South Boston producer supplies iron, steel, and alloy castings to manufacturers of locomotive, marine, and diesel power plants. The highest quality controls are applied to this type of work, and operating economies are vital factors.

Works Manager H. E. Barber, Jr., in commenting on the Gas-fired core-baking ovens, stated **"They turn out cores that are uniform in quality, thereby reducing rejections later on in the foundry. Working conditions are much improved due to the use of a clean fuel and work-saving more than justifies the cost."**

This example of the effective utilization of GAS in foundry productioneering is typical of the results to be obtained with modern Gas Equipment. Some of the important advantages of GAS in Hunt-Spiller's core-rooms can be itemized—

- **Reduction in core-baking time**
- **Greater uniformity of baked cores**
- **Improved working conditions**
- **Automatic control of baking temperature**
- **Economy of fuel effectively utilized**

Results like these are worth investigating because you'll find modern Gas Equipment for every type of core-baking requirement. It pays to keep an eye on development in Gas-fired Foundry Equipment.



Operators load one of the four modern Gas-fired core-baking ovens.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

First Aid for Plant Maintenance

AIR POWER WHERE YOU NEED IT—WHEN YOU NEED IT . . . Gardner-Denver WHD-105 Portable Air Compressor brings dependable, low-cost air power to the job location. Two-stage compression and completely water-cooled cylinders assure plenty of air for maintenance work in any season, at any altitude, regardless of weather conditions. Air-cushioned plate type valves are quiet, efficient and durable.

QUALITY CONSTRUCTION IN A SMALL COMPRESSOR . . . Gardner-Denver Air-Cooled, Tank-Mounted Compressor Outfits are made with the same care as the famous Gardner-Denver large capacity compressors. Their long-life records are the result of quality features such as drop-forged steel crankshaft, roller main bearings and plate type air valves. Useful for paint spraying, cleaning, operating air tools, tire inflation, etc.

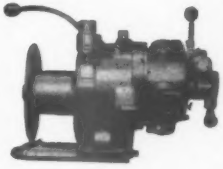
POWER—PLUS SAFETY... Gardner-Denver B87 Paving Breaker is a hard-hitting tool for rapid pavement breaking, foundation demolition, sheeting driving, etc. Exclusive safety latch prevents accidents. Lighter models are available.

RUGGED—AND EASY TO HOLD . . . Gardner-Denver T23 Backfill Tamper is powerfully built, yet is smoothly balanced for easy "walking" over the fill. Piston rod packing and butt attachment are designed to minimize maintenance.

A VERSATILE TOOL . . . Gardner-Denver Model 28 Clay Digger makes fast work of stiff clay or hardpan. Can be fitted with chisel bit or axe blade for timbering, or with moil point for light demolition. Extension handle converts digger into efficient trenching tool.

EFFICIENT AND DEPENDABLE PUMPING... Gardner-Denver VP4 Pneumatic Sump Pump is designed with top-suction — won't bury itself in a muddy sump. Automatic governor saves air when suction runs dry. For de-watering excavations, emptying tanks, bilges, sewers, etc.

For complete information on Gardner-Denver air compressors and pneumatic tools for plant maintenance, demolition or construction work, write Gardner-Denver Company, Quincy, Illinois.



FLEXIBLE HOISTING POWER . . . Gardner-Denver HB Air Hoist is powered by 5-cylinder radial air motor that provides smooth torque for accurate spotting of load. Handy for hoisting, hauling, erection, car spotting, etc. Hoists available for 1000 to 2500 lb. rope pull.

INCREASE AIR TOOL EFFICIENCY with a Gardner-Denver Line Oiler—fully atomizes oil—carefully meters flow—available in three sizes from ½ to 3 pints.

GARDNER-DENVER *Since 1859*

FIELD PROVED

Unique 9 Part Fabric

Its patented construction is entirely unlike any other. Scores of wires are stranded in 9 parts, then into three parts.

Interlaced By Machine

On special precision machines, originated by Union Wire Rope engineers, three three-strand parts are so interlaced as to form a sling fabric so much stronger, with so much tougher wearing qualities and with so much more flexibility that you just have to see how much longer service it gives to believe it.

Constructed To Prevent Rotating of Load

The inequalities of hand made slings are eliminated. The parts of Tuffy Sling fabric are so uniquely interlaced that they neutralize the load torque which causes rotating of the load on straight pulls.

Tested Strength Is Twice Safe Working Load Limits

Metal tags on Tuffy Slings give their safe working load. Each sling or leg of a bridal sling is proof-tested to twice this safe working load.

PATENT NO. 2,454,417

95% of Fabric Strength Is Developed In the Eye Splices

Here the unique interlacing of Tuffy scores again. It permits ready forming of eye splices possessing 95% of the strength of the sling fabric.

UNION WIRE ROPE CORP

union Wire Ro

Super
TOUGH

Ultra
FLEXIBLE

REG. TRADE MARK

TIES INTO KNOTS
WITHOUT MATERIAL DAMAGE

Tuffy Slings

Working any sling under load with knots or kinks in it is not recommended. But, sometimes it's unavoidable. Then is when the ultra-flexibility of Tuffy Slings stand you in good stead. Tuffy can take more of such punishment longer and you can straighten them out more often without material damage. The same is true of flattened eyes and because of the unique interlaced fabric construction, cutting of any one of the 9 strands will not result in stranding of the sling.

For a long time now, Tuffy Slings have proved they have the extra strength and ultra-flexibility to stand up during longer service on any kind of a load, under any kind of pull and with every type of hitch.

Try any one of the 9 factory packaged sizes. Prove their money-in-your-pocket worth to you to your own satisfaction.

Tuffy Sling Fabric also Available for Eye Splicing in Your Own Rigging Loft

If you are rigged for eye splicing your own slings, Tuffy Sling fabric is available on the reel. Your riggers will like the ease and speed of splicing that Tuffy interlaced construction affords.

n

pe

UNION WIRE ROPE CORPORATION

2234 MANCHESTER AVE. **KANSAS CITY 3, MO.**

☐ **Send Facts on Tuffy Slings Including Safe Working Loads of 9 Sizes Which You Deliver as Complete Packages.**

For Tuffy Slings—See Your Union Wire Rope Distributor (Listed in Yellow Section of Your Telephone Directory) and/or Send This Coupon.

FIRM NAME_____

BY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____

STATE_____

WITH HANSEN COUPLINGS

QUICK-CONNECTIVE COUPLINGS FOR

- AIR
- OIL
- GREASES
- OXYGEN
- ACETYLENE
- GASES
- STEAM
- HYDRAULIC

CONNECTION TAKES ONLY A SECOND

Threading fluid line couplings on and off to connect or disconnect is an unnecessary waste of time. Any line can be quickly and easily connected by using a Hansen Coupling. And, in addition, couplings have shut-off features that prevent loss of the liquid or gas in the line.

When you want to connect a Hansen Coupling, it is merely necessary to push the plug into place, where it locks securely. The valve opens, and flow starts instantly. The same operation disconnects—move the sleeve, and the plug pops out. Flow is shut off automatically.

From a wide range of available sizes and types you can select one suitable for any application. Air, oil, and gas, oxygen and acetylene, gasoline, hydraulic oil, and steam—each type of service has a Hansen Coupling engineered to meet its specific requirements.

If you have any fluid lines in your plant, you can increase efficiency, save precious minutes, by the use of Hansen Couplings.

Write for industrial catalog No. 47 today

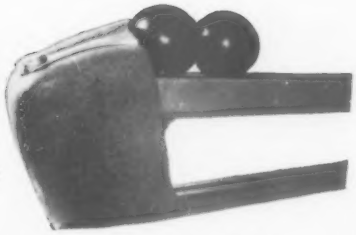
QUICK CONNECTIVE FLUID LINE COUPLINGS . . .

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Bowling Scorer's Table

Miscellaneous Parts

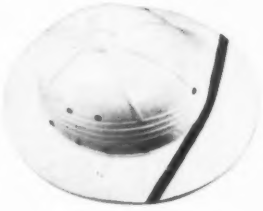


Bowling Alley Parts

Tote Boxes

Fender Guards

Mixing Bowls



Helmets

Improve your product with

u.s. Royalite

NEW, TOUGH SYNTHETIC COMPOSITION CAN BE USED FOR A MULTITUDE OF APPLICATIONS

Royalite is ideal for fabricators of thermo-plastics. It can be formed, sawed, sheared, punched, drilled, sanded, cemented, polished, all on low cost equipment. Its variety of uses is practically infinite.

This remarkable composition opens up new fields, either to improve your present product, or to design new ones. Royalite is highly resistant to severe impacts and abrasion. It can be produced in almost any color—can be finished smooth, grained, or patterned.

Technicians of United States Rubber Company will help you select the type of Royalite best suited to your purpose. Write us.

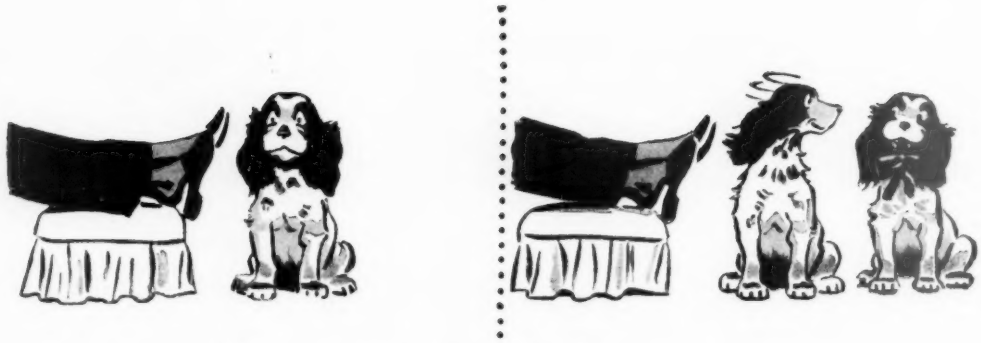
Check ROYALITE'S Advantages:

- Very high impact strength. Lightweight, non-corrosive. Excellent heat or cold insulator.
- Easily formed into compound or irregular shapes with inexpensive tools.
- In sheets any thickness from .0312 to .500 inches.
- Any color available, solid throughout its entire thickness.
- Good dielectric qualities.
- High resistance to weather elements, and to gasoline, oils and commercial cleaners. Won't warp, chip.

UNITED STATES RUBBER COMPANY

Serving Through Science

2638 Pulaski Road North, Chicago 39, Ill.



For just a little extra

You can get a lot more

W&D 2171

Allegheny Metal yields benefits that repay you many times over in lifetime beauty and utility. Wherever you need to combat corrosion and heat, or secure great strength with light weight, use this time-tested stainless steel. It vastly increases service life—vastly reduces maintenance and depreciation costs. • Compared on all counts, Allegheny Metal is *cheapest* in the long run!

Complete technical and fabricating data—engineering help, too—yours for the asking.

ALLEGHENY LUDLUM STEEL CORPORATION

The Nation's Leading Producer of Stainless Steel in All Forms

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Pittsburgh, Penna. . . . Offices in Principal Cities

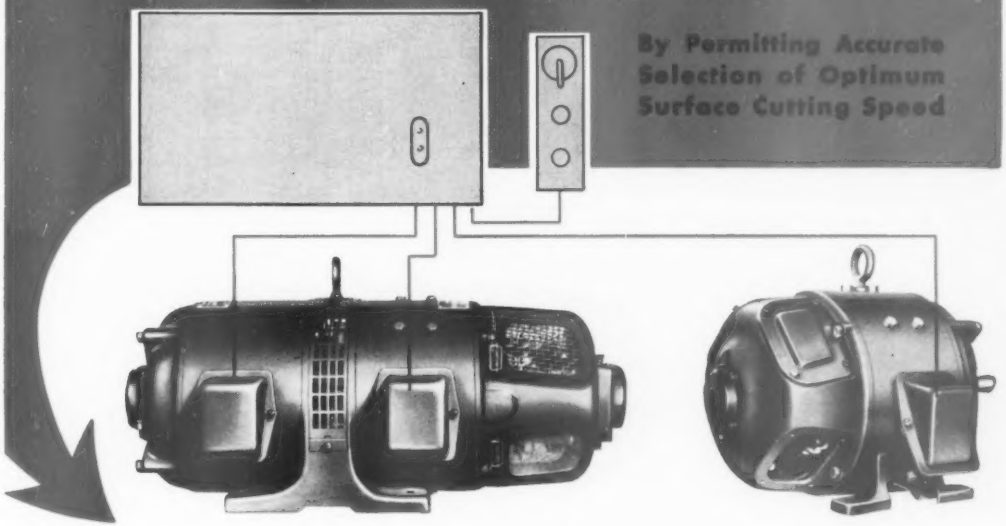
Allegheny Metal is stocked by all Jos. T. Ryerson & Son, Inc., Warehouses

Century SELECTIVE SPEED Drive

For Operation From Alternating Current

Adds These Time and Labor-Saving Features to Your Metal-Cutting Operations —

By Permitting Accurate Selection of Optimum Surface Cutting Speed



- **Higher Production Rate**—Optimum cutting speeds provide best tool temperatures for high production
- **Less "Down Time"**—less tool grinding
- **Greater Accuracy** because of less heating of tool and work piece
- **Better Machine Finish** with more efficient cutting speed
- **Adaptable to Automatic Multiple Surface Cutting Speeds**

Century SELECTIVE SPEED Drives provide a wide range of stable speeds with fine steps of control. Eight to 1 speed ratio is standard, as much as 32 to 1 is available.

When required, these additional features are available: JOGGING — DYNAMIC BRAKING — REVERSING DIRECTION OF ROTATION — PRE-SET SPEED CONTROL.

Century manufactures a complete line of alternating and direct current motors and generators in the popular types from 1/6 to 400 horsepower. A line of gearhead motors is also available.

Call a Century motor specialist to discuss your motor drive problems. Write for literature.

Popular types and standard ratings are generally available from factory and branch office stocks.

-635

Century MOTORS

CENTURY ELECTRIC COMPANY • 1806 Pine St., St. Louis 3, Missouri

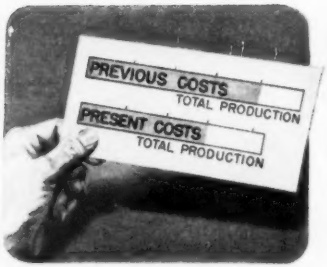
Offices and Stock Points in Principal Cities

"so your

BREAK-EVEN POINT

is going up...

Here's how WE keep our production costs DOWN!



"THIS SIMPLIFIED PICTURE shows how we stand as against last year. Our output is running about the same but we've cut our costs and substantially *increased* our margin of profit! Competitors might well envy our new, lower break-even point.

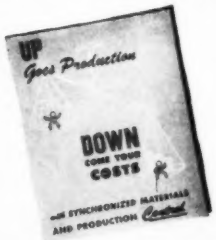
"THE SECRET IS SYNCHRONIZATION Our plant is really humming. No waste of machine time or labor; no waiting for parts—they're always at hand when needed. The reason? *Synchronized* Materials and Production Control!

"HEART OF THE SYSTEM is Kardex Visible—a centralized record that charts and coordinates our inventories of materials with present and future production requirements. Tells us—at a glance—what, when and how much to order.

"NEW, EASIER, GRAPHIC CONTROL! Here's Sched-U-Graph—Kardex in wall size. We use it to chart our machine loading and scheduling *visually* to save time, prevent errors, cut down paperwork. Like the rest of our synchronized system it pays handsome dividends through greater daily output per man and machine!"

FREE—FOLDER TELLING

16 WAYS to speed production and cut costs



Yours for the asking—a condensed description of Synchronized Materials and Production Control based on years of experience in designing and installing tailored-to-fit systems in hundreds of different plants. Phone our nearest office for your copy of Folder KD 367 or write on your business letterhead to Systems Division, Room 1105, 315 Fourth Avenue, New York 10, N. Y.

Remington Rand

Copyright 1949 by Remington Rand Inc. **THE FIRST NAME IN BUSINESS SYSTEMS**

It takes a good die shop to produce dies for deep draws and intricate contours. Because of the nature of its major industries, Detroit for many years has had die shops highly skilled in building drawing dies . . . and Allied's Richard Brothers Division has always ranked as one of the best of these.

Richard Brothers' abilities go much further than the actual building of dies. Here are men who, from long experience, know what can be done in the drawing of sheet metal. They can and do offer solutions to die design problems that show an end-result in clean, accurate stampings produced with a minimum of scrap. These are abilities that are most quickly recognized in drawing die work, yet are applied equally to the production of sheet metal dies of every type—from the largest to the smallest.

PRECISION • EXPERIENCE • ALLIED CORPORATION PRODUCTS • DEPENDABILITY

ALLIED PRODUCTS CORPORATION
Richard Brothers Division
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HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS
SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

One of the many ways that

industry makes multiple savings with Gulf Quality Oils and Greases:

machine tool plant steps up gear production, improves finishes

with **GULF LASUPAR CUTTING OIL**

A cutting oil for hobbing precision gears must have a combination of special qualities to help machine operators step up production and, at the same time, meet requirements for a fine finish on the teeth.

A large New England machine tool manufacturing plant recently made a series of exhaustive tests to determine the most efficient cutting oil for its extensive hobbing operations. Here is the report of the Foreman of the gear cutting department: "Gulf Lasupar Cutting Oil has proved superior to all other cutting oils we tested. With this outstanding cutting oil we increased production 40% and get an extremely fine finish!"

Gulf Lasupar Cutting Oil is one of more than 400 Gulf quality oils and greases which are helping plant operating men make multiple savings through improved production and lower costs. Make sure your plant is getting the advantage of recent developments in petroleum science. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Engineer to call.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:
Boston · New York · Philadelphia · Pittsburgh · Atlanta
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GULF INDUSTRIAL LUBRICATION

Helps make machines produce more at lower cost

This ROOF stays up... its cost stays down!

Applying batten seam Monel roof on new Ford Motor Company research building. Entire roof is Monel.

Monel Roofing Sheet gives you roofs and roofing parts that are good for the life of the building. Yet their cost is surprisingly low.

How many times have you wished for a metal that would just about eliminate roofing repairs?

Then take a tip from major industrial organizations who have found, and installed, such a metal.

The metal is *Monel** ... an alloy consisting of approximately ⅔ nickel and ⅓ copper.

Men who know metals, can tell you that Monel is 100% rustproof and highly resistant to corrosion by acids, alkalis and salts. This explains why Monel roofing survives so well in atmospheres contaminated by smoke, salt air and industrial fumes.

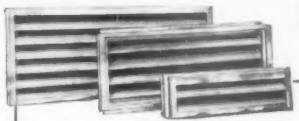
That corrosion resistance is backed up by the high mechanical properties you need in a roofing metal. Monel resists severe stresses and wear. It doesn't buckle or crack at extreme temperatures.

Monel provides a way to drastically cut your yearly outlay for roof maintenance. The proof is in its past performance. Monel roofing installations date back to 1910 ... and they are *still in good condition!*

Before you install any part of a roof, investigate Monel. Because of its strength and workability, its installed cost is reasonable — even surprisingly low.

Send for booklet, "ONE METAL ROOF"

It shows typical installations, tells about Monel's many advantages, cites long-service records. Included is a "test-it-yourself" sample of Monel Roofing Sheet.



MONEL *cuts Louver Sheet Thickness 25%*

Here's how Monel makes possible substantial reductions in the sheet thicknesses used for standard roofing parts. A large corporation needed 50 louvers in assorted sizes. By specifying Monel (with its superior corrosion resistance and high mechanical properties), it was possible to reduce the sheet thickness. Result: longer-lasting, economical louvers . . . and a 25% saving in weight. Remember, "Monel Roofing" is a broad term; it includes entire roofs as well as drainage systems . . . flashings . . . skylight frames . . . ventilators . . . louvers . . . siding . . . expansion joints . . . copings.

MONEL ROOFING

For the "Life-of-the-Building"

EMBLEM OF SERVICE

INCO

TRADE MARK

Architectural Section
The International Nickel Company, Inc.
67 Wall St., New York 5, N. Y.

Please send me a copy of "ONE METAL ROOF" and the sample of Monel Roofing Sheet.

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Title.....

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Address..... F M M 7-49

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THE INTERNATIONAL NICKEL COMPANY, INC.

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67 Wall Street, New York 5, N. Y.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

IT'S EASIER!

if you plan your power distribution system first

Eliminate plant shutdowns due to power system changes. Realize new plant economies!

Plan your Power System *before* you set up your new production areas. Choose the "one best" system that answers *all* of your power requirements.

It may not be the system with the lowest initial investment. *But,* it will prove to be the lowest in cost *over a period of years.*

Remember—production records are set *only* if your power system can handle the load. The problem of selecting such a system varies. BUT . . . *Westinghouse can help you find YOUR answers!*

We have worked in close co-operation with *all types* of industries. This wide application experience has given us an intimate knowledge of every phase of power distribution and applications.

CONSULT WESTINGHOUSE . . . and get real help in adapting distribution systems to *your* specific problems. J-94789

If you're expanding or building a new production area . . . get this invaluable information NOW!

1. **A New 34-Page Booklet:** "Industrial Plant Distribution System", B-4045. Fact-filled pages and colorful diagrams present the basic systems most widely used in industry today. Find how to choose the *best system* for *your* plant.

2. **System Selector:** A wealth of information condensed to a pocket-size selector! In a matter of minutes you can make preliminary estimates on the system that answers *your* requirements. Ask for SA-6116.

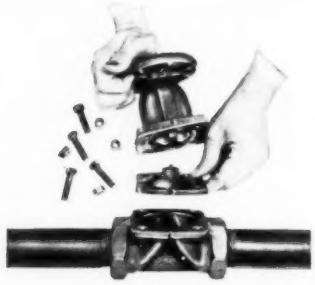
3. **Color Movie:** Get all the facts visually! This 16mm full-color movie is a 20-minute dramatization that will point the way to new economies in plant power distribution. Ask one of our representatives for a free showing of "The Right Power Distribution System". No obligation, of course.

Call your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Westinghouse

SYSTEM PLANNING SERVICE

Easy as fixing a faucet



THE GRINNELL-SAUNDERS DIAPHRAGM VALVE has only one part that normally wears and needs replacement . . . the diaphragm. Depending on the type of service, it may last for years or only months. It can be replaced in just a few minutes. The valve body doesn't have to be removed from the pipe line . . . only the bonnet. The new diaphragm is attached to the bonnet which is then bolted back onto the valve body . . . and the valve is restored to service. That's all the maintenance a Grinnell-Saunders Diaphragm Valve normally needs. No packing glands to demand frequent attention. No refacing or reseating required, because there are no metal-to-metal seats to become damaged or wire drawn.

SIMPLE, POSITIVE OPERATION . . . Flexible diaphragm opens wide for streamlined flow, pinches tight for positive closure even when grit, scale or other solid matter is trapped on the weir.

NO CLOGGING . . . MINIMUM RESISTANCE TO FLOW . . . Smooth, streamlined fluid passage without pockets prevents accumulation of sludge and reduces friction resistance to a minimum.

NO CORROSION . . . NO CONTAMINATION . . . NO LEAKS . . . The working parts of the valve are completely isolated from the fluid by the diaphragm. Diaphragm materials, body materials and body linings are available to suit service requirements.

Available in various combinations of valve bodies and operating mechanisms. Write for catalog.

99 YEARS PIPING

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with **ORTON**

ONE-MAN

AERO-CRANE

POWERMATIC AIR-CONTROL

No Afternoon Fatigue Let-Down

One Man, with the Powermatic Air-Control Orton Aero-Crane loads and unloads cars, trucks, gets material onto the stockpile and off with *early-morning* efficiency *all day.*

Effortless Orton air-control enables one man with the Aero-Crane to handle 200 to 1000 lb. loads that eat up the time of a yard crew. Aero-Crane pays for itself in saved man hours.

Designed to SPEED Yard Work

Orton one-man Aero-Crane travels rapidly job to job with boom in any position.

Insures SAFE lowering of heavy loads against *compression of the engine.*

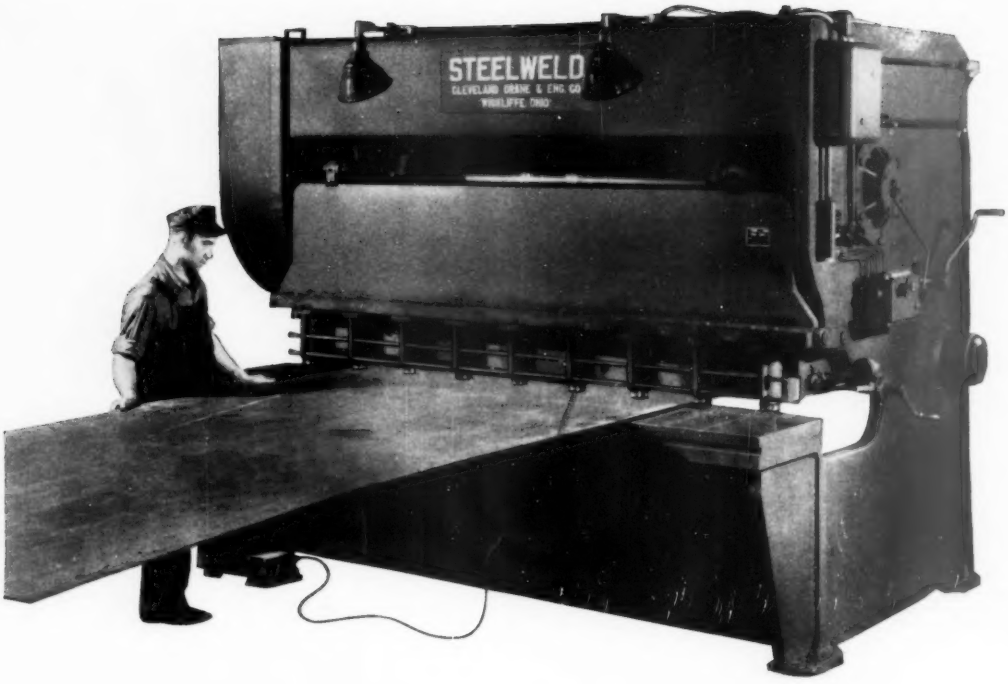
Full-view cab. Full circle turntable. Anti-friction bearings. Non-burn Orcoin V-type clutches. SAFETY spring-applied, air-released hoist brakes. Electro-welded construction.

Eight models, 3,500 to 60,000 lbs. capacity. Diesel or gasoline powered.

Send for Catalog 73-B for full details and roster of Orton world-wide users

◀ Long-life Orton Aero-Crane has most rigid car body of any crane built. Goes anywhere a truck will go. Operated, traveled and steered from craneman's seat.

ORTON **CRANE & SHOVEL COMPANY**
608 South Dearborn Street, Chicago 5, Illinois



ALL STEELWELD SHEARS
CONTROLLED ELECTRICALLY...

OPERATION of Steelweld Shears is unusually easy and convenient. There is no tiresome lifting of the leg to work a foot treadle. Slow, fatiguing knee action has been replaced by fast easy toe action.

A safety type electric foot switch is used. It can be slid around the floor wherever most convenient. It enables shearing speeds not attainable with foot treadles for certain cutting operations.

For instance, when cutting narrow strips from a long sheet, the operator can push the sheet at the end and control the shear at the same time. He need not be near the machine. As the sheet becomes shorter he can move the switch along with his foot to always be within easy reach.

There is no extra charge for electrical foot control on Steelweld Shears — it is standard equipment on all size machines.

Steelweld Shears are radically different from all other shears with many outstanding features. Get the facts on these truly new and modern machines. Learn about the advantages they offer you.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

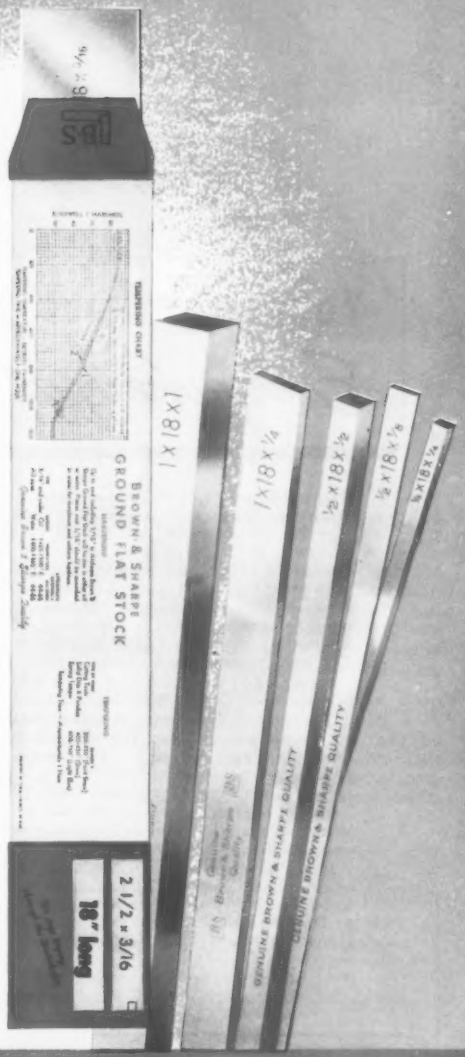
3203 EAST 282nd STREET · WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

An Important Cost Saver!

for templates, cutting tools, gages, test tools, machine parts and many other items . . .

Brown & Sharpe GROUND FLAT STOCK



SAVE TIME . . . SAVE MONEY

Here's one way to beat high costs. By making small parts from stock accurately pre-ground to size, you can avoid expensive, difficult grinding operations. What's more, you save man-hours and machines for more profitable work.

Brown & Sharpe Ground Flat Stock is accurate to within .001" in thickness. It is selected first-quality tool steel, annealed uniformly by a special process to make machining easy. Up to and including 3/16" in thickness, hardens in either oil or water to 64-66 Rockwell C. Pieces over 3/16" should be quenched in water for full hardness.

Brown & Sharpe Ground Flat Stock in 18" lengths is available in sizes that cover most requirements. Get an adequate supply from your Brown & Sharpe distributor. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Regular stock sizes include 13 different thicknesses from 1/64" to 1/2" . . . widths up to 6" . . . also square sizes. Individually packaged in clean, protective envelopes marked with size and heat treating instructions. Easy to store. Easy to handle.

We urge buying through the Distributor

BROWN & SHARPE

Your watchman can't be *Everywhere at Once!*

You need protection night *and* day. First-floor windows, windows bordering fire escapes and windows near roofs of adjoining buildings are danger spots that should be guarded. Fenestra* Security Windows protect your plant both from prowlers and from passage of material through windows. Even if all the glass is smashed or the ventilators left open.

Here's a combination of a strong steel grille and a ventilating window. The ventilator is superimposed on the inside of the grille. It's bottom-hinged to swing in at the top, deflecting drafts upward. The self-locking spring catch makes opening and closing easy.

Screening is easy, too. You can quickly install Fenestra All-Metal Screens from *inside*. Just slip them between ventilator and grille.

There's a *right* Fenestra Window for every daylighting and ventilating job in your plant. For offices, too, and labs, warehouses and other buildings. All are standard windows . . . Fenestra production volume permits standardization of a large variety. That's why the cost is low—the quality so uniformly good.

Shown here are three representative types of Fenestra Industrial Windows available in many heights and widths. Each is warp-proof, and firesafe and economical.

Let us help you determine the best types for *your* needs. We'd be glad to have our staff of engineers make you a detailed window layout for your plant . . . at no obligation. For full information, write to Detroit Steel Products Company, Department FM-7, 2266 East Grand Boulevard, Detroit 11, Michigan.

PIVOTED WINDOW

Widely used for an abundance of daylight, fresh air and see-through vision, to improve morale and production efficiency. Combine vertically or horizontally to form entire walls of windows.

COMMERCIAL PROJECTED WINDOW

Popular for efficient, economical screening or shading—vents do not interfere. Open-out vent serves as a canopy over opening, protecting interior against rain; open-in vent is a built-in windguard, shedding water outside.

SECURITY WINDOW

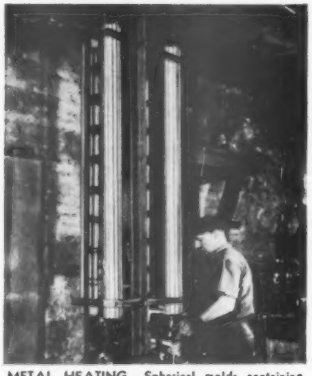
A steel window with integral steel grille to bar prowlers. Passage of material is checked, too. Ideal for first floors, windows bordering fire escapes and windows near roofs of adjoining buildings.

Fenestra

INDUSTRIAL STEEL WINDOWS

APPLICATION REPORTS
from the
CHROMALOX FILES

DEHYDRATING. Vari-colored powders for injection molding machines are completely and uniformly dried in 10 to 15 minutes with Chromalox Radiant Heaters.



METAL HEATING. Spherical molds containing compressed kapok are heated to 300° F. in one pass through a vertical oven formed with Chromalox Radiant Heaters.

ASPHALT-MELTING. Asphalt sealing compound is melted to provide proper "knit" between it and battery case. Bank of Radiant Heaters with variable control is installed in conveyor top. Side reflector sheets add efficiency.

Chromalox

For INFRARED

- Drying
- Evaporation
- Mass Heating
- Preheating
- Skin Drying
- Baking

and many other Applications

Quick, Low Cost Installation dependable service

FLEXIBLE! Easy to install in tunnels, single banks, double banks, ovens, etc. Gives infrared radiation in longer wave lengths which are absorbed almost equally well by all colors and textures of surfaces.

UNBREAKABLE! Rugged all-metal construction with aluminum body and shockproof, Inconel-sheathed CHROMALOX tubular heating element. Withstands shock, vibration, moisture and dust.

EFFICIENT! CHROMALOX tubular elements operate at 1400° F. Uniform, even heat—without "hot spots"—in low or high ambient temperatures. Units operate efficiently in all positions and at all angles.

COMPACT! Only 2 inches deep in nominal lengths of 2, 2½, 4, 5, 6 and 7 feet. Sections may be quickly interlocked to form their own oven, which can be further insulated for low, minimum heat losses.

CHROMALOX
Electric heat for modern industry

EDWIN L. WIEGAND COMPANY
7518 THOMAS BLVD. PITTSBURGH 8, PA.

I'm Interested —

Send me complete application reports on Chromalox Electric Radiant Heaters

Name.....
Company.....
Street.....
City.....Zone....State.....
Number of Reports Required.....

IC-45

It's a long, long grind...

but it's not too tough for Wagner *CP* Motors

Glass is vital to modern automobile production. Grinding and polishing vast amounts of safety glass to the perfection demanded by the Ford Motor Company require 24 hour operation with huge lines of machines like the one pictured above. This installation consists of two grinding lines with 60 units and two polishing lines with 100 units. It is significant that each unit is driven by a Wagner 40 hp type CP motor!

Wagner type CP totally-enclosed, fan-cooled motors are designed to operate efficiently in atmospheres filled with dust, fumes, moisture and other agents that quickly ruin open type motors. They stay on the job, requiring no maintenance other than periodic lubrication, in spite of the destructive elements in the surrounding atmosphere. You will find CP motors a lasting investment in continuous, troublefree motor performance.

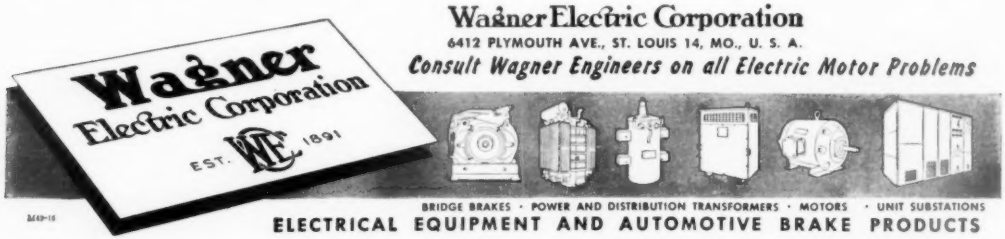
More than fifty-five years of experience stand behind every motor bearing the Wagner name. Nationwide service facilities are available to users of Wagner Motors.

Call any of our twenty-nine branch offices located in principal cities and manned by trained field engineers, for advice on all of your motor problems. Bulletins on the complete line of Wagner Motors will be sent upon request.

Wagner Electric Corporation

6412 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on all Electric Motor Problems



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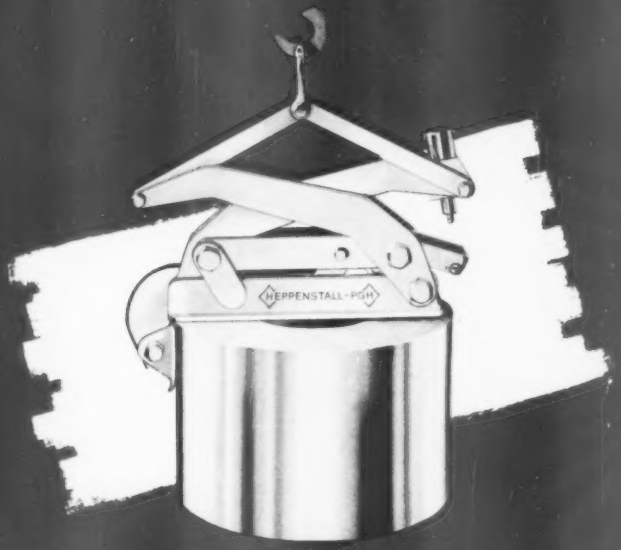
ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

Heppenstall

AUTOMATIC SAFE-T-TONGS

—cut handling costs
—save time safely



AUTOMATIC PICK-UP

AUTOMATIC EJECT

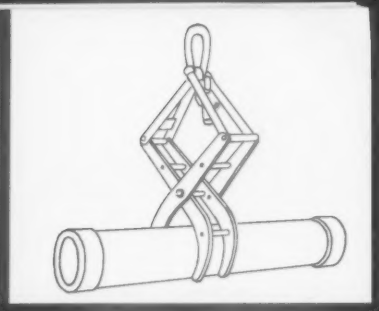
AUTOMATIC RELEASE

Adaptable to a wide variety of material handling applications, Heppenstall Safe-T-Tongs are fully automatic—no power driven. Attached to the hook of your crane or hoist, they replace chains or slings—reduce accidents—save manpower, time, and money.

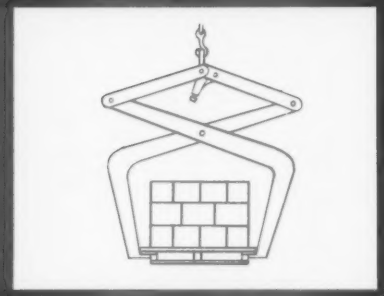
If you have a repetitive handling problem, consider the efficiency of a Heppenstall Automatic Safe-T-Tong engineered to your needs. Heppenstall engineers will gladly cooperate in developing a type of tong to speed your work. Write today for your copy of our new Tong Booklet. Heppenstall Company, Pittsburgh 1, Pa.

HEPPENSTALL COMPANY

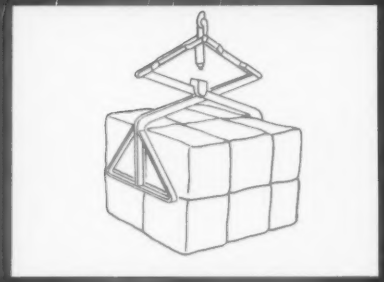
Pittsburgh Bridgeport Austin



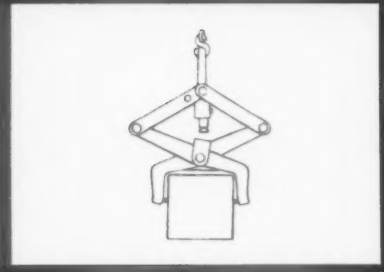
. . . FOR PIPES OR BARS



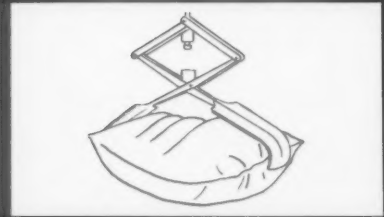
. . . FOR PALLETS



. . . FOR BALES



. . . FOR RECTANGULAR SHAPES



. . . FOR SACKS

Enjoy made-to-order weather with American Blower Cooling Coils

You can produce cool and inviting *indoor* weather even on the hottest summer days with American Blower Cooling Coils. And the same system can provide cozy warmth next winter with a companion set of American Blower Heating Coils.

Important to your business? Sure it is!

And just as important is the fact that American Blower heating and cooling coils, unit heaters, ventilating fans, utility sets and air conditioning units are standard items available for prompt delivery.

These dependable products can be easily and quickly installed in all types of industrial and commercial buildings.

They are built and backed by American Blower with more than 68 years' experience in building air handling equipment.

Call our nearest Branch Office, located in 57 principal cities of the United States and Canada, for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

American Blower Type W Cooling Coil. For use with cold water. Also available, Type X coils for systems utilizing direct expanded refrigerants.

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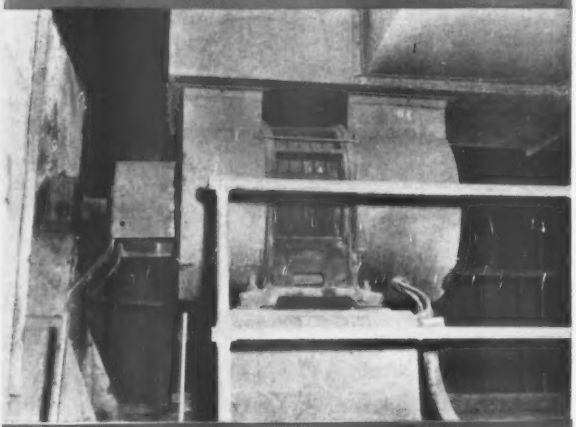
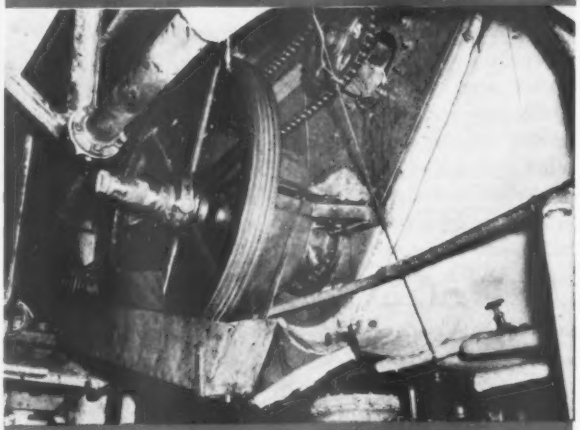
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

FEED WATER PUMP . . . 200° F.



AIR FAN . . . OVER 300° F.



SUGAR MIXER . . . 150° TO 250° F.

Now, one grease withstands both heat and water

BEARING LUBRICATION posed a continual problem for a midwest sugar-refining company.

The ball bearings in feed-water pumps operate around 200° F. and, in addition, are exposed to the washing action of water. The ball bearings in air fans have operating temperatures over 300° F. The shaft bushings in a sugar mixer operate at around 200° F. and are subjected to continuous attack by the sugar-water mixture.

These conditions proved too severe for conventional greases. Bearings failed frequently. Maintenance costs were high. A Standard Oil Lubrication Engineer tackled the problem. He suggested the use of Stanolith Grease—a lithium soap product with the unusual ability to withstand both high temperatures and the washing action of water.

The switch to Stanolith has eliminated bearing maintenance for the feed-water pumps. Bearings in the air fans have been kept in almost continuous operation. On the most difficult job of all, Stanolith has prevented bearing wear and seizure troubles in the sugar mixer. Costly shutdowns and repairs of the mixer have been eliminated.

Where both heat and water interfere with lubrication of your equipment, try Stanolith Grease. A Standard Oil Lubrication Engineer will be glad to give you more information about this versatile product.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

Stanolith Grease

STANDARD OIL COMPANY (INDIANA) STANDARD

K-3250-A—Kohler Flambeau Octagonal Enameled Wash Sink, for bottom supply and vent. Specify K-3252-A for overhead connection. Four unit powdered soap dispensers shown with brackets available.

KOHLER FLAMBEAU *Enameled* WASH SINKS

have the practical features you want

Accommodation for several persons at one time, with a separate faucet with sprayer for each, is provided by the Kohler Flambeau Enameled Wash Sink. When installed in a locker room, a series of these wash sinks can be saving of both space and water. The glass-like, non-porous, acid-resisting, enameled surfaces assure the utmost in sanitation with a minimum of maintenance—at the same time providing a good-looking installation.

A temperature control valve mixes hot and cold water to the temperature desired. The sprayer on each faucet sends water directly down into the basin, and will not spray over the sides if pressure is increased. Faucets are designed to conserve water while providing a generous supply for the user. Each faucet has a lever to regulate water volume.

Write for information on other Kohler fixtures for industrial use, such as showers, drinking fountains or lavatories. Kohler Co., Dept. 6-J, Kohler, Wisconsin. Established 1873.

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS

5 Wiring Ideas ...TO BRIGHTEN YOUR PLANS

A specific wiring material for a specific job—that's the new idea in planning for a productive, profitable drafting room. To help you make the right choices every step of the way—we've picked five tailor-made ideas right off your General Electric distributor's shelves. Look them over for real help in your planning job.

1. UNDERFLOOR WIRING is the ideal system for this kind of equipment. G-E Fiberduct raceways or Q-Floor Wiring provide for outlets in the floor practically anywhere, any time they're needed. As room arrangement is changed—as desks are moved—as electrical appliances are added—outlets can be moved or added, too, in a matter of minutes. For a drafting room that keeps pace with the times, give it flexibility with G-E Fiberduct or Q-Floor Wiring.

2. MERCURY SWITCHES are General Electric's silent switches you've heard so much about. They're made for spots where people constantly flip lights ON and OFF. After years of operation, they keep on doing their job well. A pool of mercury flows from the open to closed position silently—with no apparent friction or wear. G-E mercury switches fit wherever standard switches fit—carry a full 10-ampere rating.

*Trade-mark Reg. U. S. Pat. Off.

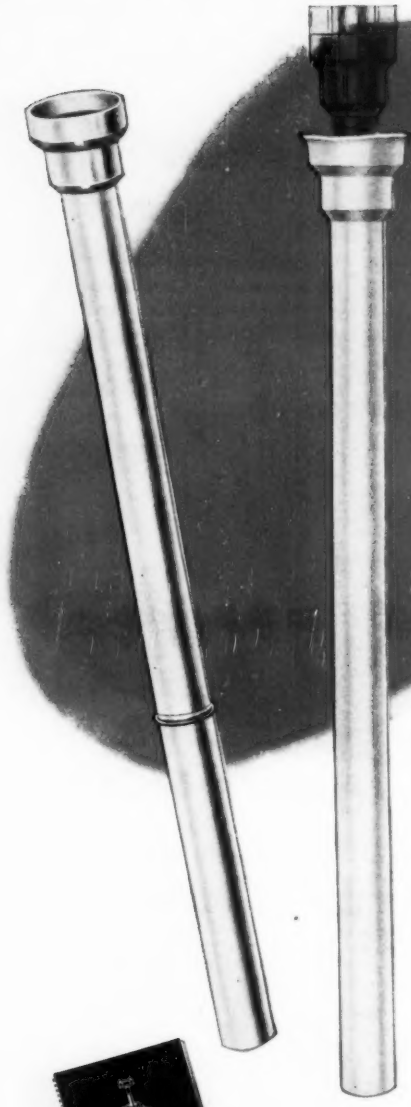
3. TYPE TW WIRE. Here's another good bet for the installation that's going to stay modern in the years ahead. Small-diameter, long-life General Electric Type TW wire conserves space in conduit—leaves room for additional wiring later on, without additional raceways. This smooth, thermoplastic wire is an installation-timesaver, too, because it pulls through conduit easily—makes cutting and stripping a fast operation.

4. CONDUIT, of course, should be General Electric White—the rigid conduit that's hot-dip galvanized to stand up through the years. Wherever installation plans call for long life and low maintenance costs, specify G-E White.

5. HEAT-RESISTANT Deltabeston* fixture wires are a "must" in a location like this. Where lamps burn continuously, heat-beating Deltabeston wires are a wise precaution. Make sure they're part of every fixture you buy. And, to make your fluorescent installation complete, specify G-E Watch Dog* starters. They automatically cut out blinking lamps—keep lighting continuous and even.

Why not get the habit of looking to your General Electric distributor for ideas and advice—as well as for wiring materials? He has a full line of materials to choose from—and a wide range of experience he'll gladly share with you. Contact him for information—or write to Section K14-434, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC



What makes it a.. one-punch part?

Alcoa's Impact Extrusion process formed this valve tube in one operation, complete with fully formed head—and held it to close tolerances.

Alcoa's process often gives you one-piece parts at substantially lower cost than stamping, drawing, spinning or machining. Select any commercially practical finish, plus lustrous Alumilite* exclusive to aluminum.

Get the whole story about how Alcoa Impact Extrusions can help you produce at lower cost—and sell more—because of aluminum's light weight, strength, corrosion resistance and handsome appearance. Call your nearby Alcoa sales office, or write for your free copy of "Alcoa Aluminum Impact Extrusions" to ALUMINUM COMPANY OF AMERICA, 2126G Gulf Building, Pittsburgh 19, Pennsylvania.

*Patented process

WRITE FOR FREE BOOKLET

ALCOA *Aluminum* **IMPACT EXTRUSIONS**

ALCOA ALUMINUM

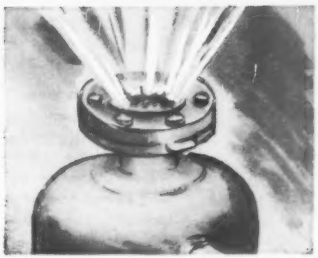
INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

POSITIVE PROTECTION for Your Men and Equipment

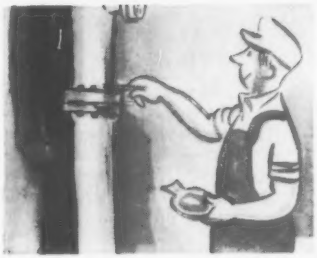
Complete your protection against overpressure with BS&B SAFETY HEADS!

The BS&B SAFETY HEAD is a pressure fuse . . . a weak spot built to insert in the pressure vessel wall or in a line connected to the vessel. It may be used as the sole pressure relief device or as a supplement to a relief valve.

Here are its features:

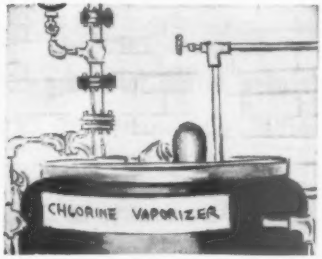


Instant action. Ruptured disc provides a full-throated, pipe-sized escape opening . . . gives unrestricted relief.



Inexpensive rupture discs are easily and quickly replaced. They fit securely between two bolted flanges.

Wide range of protection. 5 to 30,000 psi at operating temperatures from below 0° to 800° F.



Used with all types of gases and liquids. No trouble with corrosive or sticky substances.

CLIP THIS COUPON AND MAIL TODAY!

Today thousands of plants are safe. They are getting complete protection with BS&B SAFETY HEADS. Give your plant this complete protection. Let a BS&B sales engineer help you make a survey of your plant.

BS&B SAFETY HEADS

Special Products Div., Section SH-7, BLACK, SIVALLS & BRYSON, INC.
Power and Light Building, Kansas City 6, Missouri

I want full details concerning BS&B SAFETY HEADS.

☐ Please forward complete data. ☐ Arrange to have Sales Engineer call on me.

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CITY_____ ZONE_____ STATE_____

MORE HOURS OF TUBE SERVICE when you replace with GL-5545's!

"YOU CAN PLUG THESE LONG-LIVED MOTOR-CONTROL THYRATRONS RIGHT IN YOUR PRESENT C6J AND 306 SOCKETS"

GL-5545's serve longer because of their oversize charge of gas — twice as large as with former types. This offsets anode gas absorption caused by the inductive load found in field and armature-control circuits. Up to now, loss of gas content has been the principal enemy to long life of electronic tubes for motor control.

So you save, with GL-5545's . . . by buying a bigger number of performance hours. And you help assure high production from your millers, grinders, planers, lathes — from your looms, presses, or other motor-driven machines — when you install these *dependable* thyratrons!

The GL-5545 is reliable because it's strongly made . . . shock-resistant. Because a special shielded-grid design gives it electrical stability. In welder-control work as well as for motor control, the tube's dependability plus its high voltage rating are important advantages.

Ask your G-E tube distributor for price and full information! Your nearby G-E electronics office will be glad to cooperate in putting you in touch with this well-stocked tube supply source, located right in your area. Or write *Electronics Department, General Electric Company, Schenectady 5, New York.*

GL-5545

Filament voltage	2.5 v
Filament current	21 amp
Peak anode voltage, forward and inverse	1,500 v
Peak cathode current	80 amp
Avg cathode current	6.4 amp
Current averaging time	15 sec
Ambient temp range	−55 to +70 c

G-E electronics offices are located in the following cities:

ATLANTA 3, GEORGIA
187 Spring Street, N. W.
Phone: Walnut 9767

BOSTON 1, MASSACHUSETTS
140 Federal Street
Phone: Hubbard 1800

CHICAGO 54, ILLINOIS
Merchandise Mart
Phone: Whitehall 3915

CINCINNATI 2, OHIO
215 West Third Street
Phone: Parkway 3431

CLEVELAND 14, OHIO
710 Williamson Building
Euclid Ave. and Public Square
Phone: Superior 6872

DALLAS 2, TEXAS
Norman Bldg., Ross & Lamar Sts.
Phone: Riverside 9121

DENVER 2, COLORADO
650 Seventeenth Street
Phone: Keystone 7171

KANSAS CITY 6, MISSOURI
106 West 14th Street
Phone: Victor 9745

LOS ANGELES 14, CALIFORNIA
Suite 1300-1301
Security Title Ins. Bldg.
530 West 6th Street
Phone: Madison 7381

NEW YORK 22, NEW YORK
570 Lexington Avenue
Phone: Plaza 5-1311

PHILADELPHIA 2, PENNSYLVANIA
1405 Locust Street
Phone: Pennypacker 9000

SALT LAKE CITY 9, UTAH
200 South Main Street
Phone: 4-1892

SAN FRANCISCO 6, CALIFORNIA
235 Montgomery Street
Phone: Douglas 3740

SEATTLE 11, WASHINGTON
710 Second Avenue
Phone: Main 7100

You can put your confidence in—

GENERAL ELECTRIC

GL-5545

180-HA30

13 REASONS FOR USING **HARPER** NON-FERROUS AND STAINLESS STEEL FASTENINGS

1. **Resistance to Rust and Corrosion**
2. **Resistance to High Temperatures**
3. **Non-Magnetic**
4. **Non-Sparking**
5. **Re-Usable**
6. **Attractive Appearance**
7. **Easy to Clean**
8. **High Strength**
9. **Long Life**
10. **Lower Ultimate Cost**
11. **Resistance to Fatigue**
12. **Easy to Plate or Finish**
13. **Resistance to Abrasion and Wear**

Only 1 Reason for Using Common Steel — LOWER FIRST COST

6000 ITEMS IN STOCK. The widest assortment of bolts, nuts, screws, washers, rivets and accessories in Brass, Bronzes, Copper, Monel and Stainless Steels available from one source . . . large quantities of each. Specials made to order from ample stocks of raw materials.

Write to General Offices, Dept. F, for our 134-page Color Catalog giving blue print drawings, dimensions, threads, heads and sizes of each item. Special Stainless Steel Catalog also available upon request.

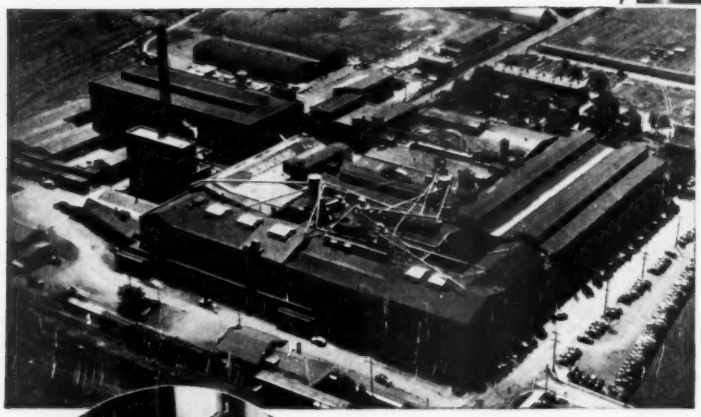
THE H. M. HARPER COMPANY
General Offices and Plant: Morton Grove, Illinois
(Suburb of Chicago)
New York Office and Warehouse: 200 Hudson Street, New York 13
Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Los Angeles, Milwaukee, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle, Toronto (Canada)

EVERLASTING FASTENINGS

THE MAGEE CARPET COMPANY

Plant-Wide Sound System

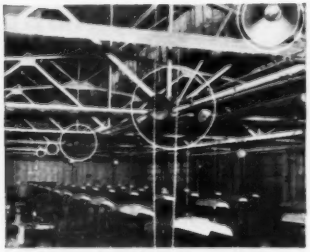
Designed and installed by RCA for increased productive efficiency and happier working conditions



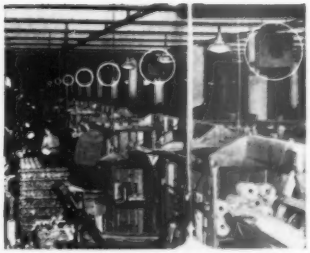
Mr. H. L. Magee, President, addressing employees throughout the plant from his office. Wire or tape recordings are made of management talks for play-back over the sound system to later work shifts.

The Magee Carpet Company, Bloomsburg, Pa., utilizes one of the most extensive and complete RCA Sound Systems. Sound coverage extends over an area of 15½ acres of floor space where 2000 workers are employed. 400 loudspeakers supply high or low level sound to the various areas of the plant.

Mr. Leo C. McNamee operating the RCA Sound System from the central control console. By means of selector keys broadcasts are channeled to groups of loudspeakers installed in various areas of the plant.



A group of powerful loudspeakers scientifically located enables workers to hear easily and clearly the sound system broadcasts through the surrounding noise of the busy broadlooms in the Velvet Weave Department.



In the Axminster Setting Department an RCA 12-inch loudspeaker installation assures maximum sound volume and complete distribution of page calls, work music, news or management messages.

RCA Sound Systems are flexible and "unit-built" to fit specific requirements.

In the Magee Carpet Company installation, RCA's Sound System provides for plant-wide broadcasts originating from microphones located in the studio, at the control console, offices of the President, Vice President and Personnel Director. Also from a telephone line from Station WLTR, transcription turntables, AM or FM radio, wire or tape recorder, the guard at the main entrance to the plant and paging by the telephone operator.

* * *

RCA sound engineers will be glad to make a survey of your plant and map out a sound system for the individual needs of your organization. For complete information, contact your nearest RCA Sound Products distributor, or write: RCA Sound Products, Dept. 117-G, RCA, Camden, N. J.

SOUND PRODUCTS

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

LITTLE HOIST BIG VALUE!

Save every time you use it!

Next time you want to cut your departmental costs, think of the Zip! This small electric hoist costs so little — *saves so much* that you can't lose. You press the buttons; the Zip does the rest — with any load up to 2000 lbs.

The Zip-Lift gives you many extras, without extra cost. (Note the Added Values below.) In design, in power, in toughness, in dependability, the Zip adds up to America's finest small hoist — and the greatest small hoist value. That's what makes it the leader it is!

Write for this helpful booklet filled with practical cost-saving ideas. Ask for Bulletin H20-4!

Handle it "thru-the-air" at lower cost

THESE ARE ADDED VALUES!

SAFER — Full magnetic control with current reduced to 110 volts at the push-button. No open wiring. Plugging crane type limit switch and larger double brakes provide maximum safety.

LIFETIME CONSTRUCTION — Precision built — shaved gears running in oil — grease-sealed antifriction bearings — fully enclosed, moisture-proof, dust-proof, acid-proof.

SMOOTHER OPERATION — Motor specifically built for hoist service to withstand frequent reversal. Loads controlled within a fraction of an inch.

ALERT SERVICE — Out-of-stock delivery from qualified dealers everywhere — also backed by 18 branch offices and conveniently located warehouses.

Available in capacities up to 2000 lbs.

P&H **ELECTRIC HOISTS**

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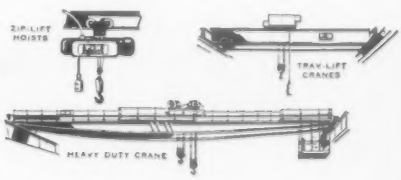
HARNISCHFEGER CORPORATION

HOISTS · WELDING ELECTRODES · MOTORS · P&H · EXCAVATORS · ELECTRIC CRANES · ARC WELDERS



got a job for DRIER ROLLS?

PATENTS APPLIED FOR

Here's how to do it faster

Lukenweld Jacketed Steel Rolls have helped dozens of companies speed up operations—heating or chilling materials to dry, crystallize, harden or otherwise condition them. Records covering hundreds of these rolls show production increases as high as 41% without increasing steam pressures. When pressures are elevated, production increases to over 60% can be achieved.

The jacketed, steel plate construction of Lukenweld Rolls does the trick. Steam, circulating through their narrow passages, moves at high speed; condensation is removed positively and continuously. Heat (or cold, if it's a chilling job) is transferred rapidly and uniformly through the comparatively thin but strong steel walls. Lukenweld Jacketed Steel Drier Rolls can be safely operated at pressures of 350 psi and higher.

Whether your job calls for rolls alone, an addition to present equipment or a complete new machine, Lukenweld engineers are prepared to engineer and build it for you. For such help, or for Bulletin 358 on Lukenweld Rolls, write Lukenweld, Division of Lukens Steel Company, 421 Lukens Building, Coatesville, Pennsylvania.

We'll lend you "LUKENWELD", a 16mm motion picture with sound, highlighting our methods, facilities and products. Running time: 20 minutes. Write for booking date.

LUKENS
LUKENWELD DIVISION

DESIGNERS, ENGINEERS AND MANUFACTURERS OF MACHINERY

THE BEST LIFT TRUCK FOR INSIDE WORK

MOVE MORE MATERIALS

Inside your plant with a HYSTER® LIFT TRUCK

The complete Hyster line of trucks—7 models (2,000 lb. to 30,000 lb. capacity) are gasoline powered; all are equipped with pneumatic tires. Illustrated at top of page is Hyster 20; above, Hyster 40.

Saves Floors...Cuts Maintenance Costs. More Speed, More Traction, More Maneuverability.

The Hyster Pneumatic Tire "Easy Ride" is easy on floors—easy on the load—engineered for greater maneuverability in narrow aisles and crowded warehouse spaces. HYSTER IS THE IDEAL LIFT TRUCK FOR INSIDE WORK.

Big PNEUMATIC TIRES CUT DOWN FLOOR SURFACE REPAIRS, practically eliminate damage to costly floors. TRACTION and RAMP CLIMBING ability is increased. Operator fatigue is reduced.

Your Hyster Distributor will demonstrate a Hyster 20 (2,000 lb. capacity) or a Hyster 40 (4,000 lb. capacity) for your *inside and outside* materials handling jobs. You can check your own savings. SEE FOR YOURSELF or write for literature.

HYSTER COMPANY

THREE FACTORIES

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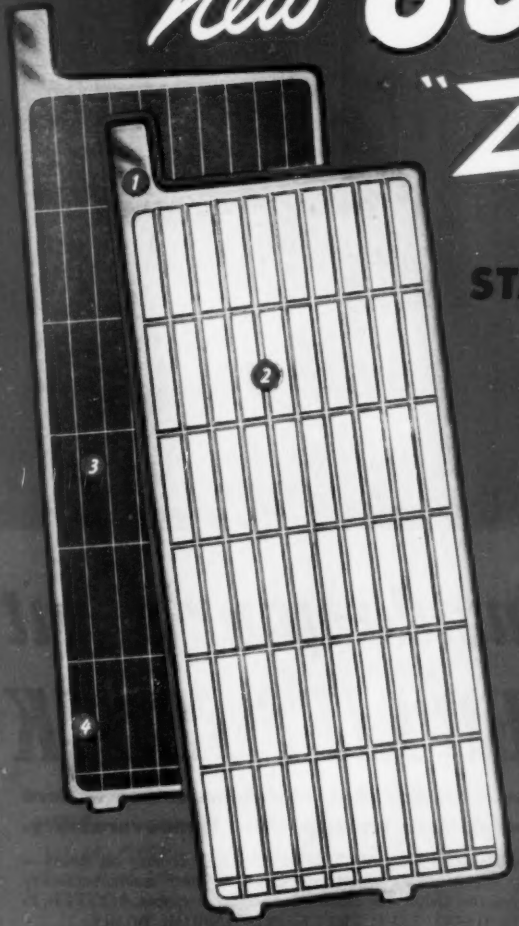
1856 NORTH ADAMS STREET . . . . . PEORIA 1, ILLINOIS
1056 MEYERS STREET . . . . . DANVILLE, ILLINOIS

HYSTER

New GOULD "Z" Plate

BATTERIES STAY NEW LONGER



From Gould's modern laboratories and pilot plant comes a revolutionary new plate design that greatly improves battery performance. The new Gould "Z" Plate means that Gould batteries stay new longer! Here's why:

1. Solid, non-porous positive grid.
2. All grid members are heavy with same cross section.
3. Regenerative oxide renews itself throughout battery service.
4. More active material per battery pound.

Available shortly in all "Thirty" and "Kathanode" types. Ask for literature on how Gould's new casting techniques improve battery performance.

The Gould "Thirty"
More than ever—America's
Finest Industrial Truck Battery

GOULD

STORAGE BATTERY CORPORATION

TRENTON 7, NEW JERSEY

Always Use Gould Automobile and Truck Batteries

THE GOOD RIGHT HAND OF INDUSTRY

Meet the Only

NEW Air Compressor Line *Since the War*

It's the Worthington Balanced Angle—the really modern-looking vertical air compressor that is as up-to-date *inside* as out!

See how this machine has been redesigned from the bottom up to give you everything we know you want in an air compressor—

You Get Smoother Performance because the V-type cylinder arrangement gives better running balance and faster cooling.

You Get Higher Efficiency because the isolated cylinders have 35% more heat radiating surface than in-line type; the aluminum heads release heat faster than cast-iron; and the high-speed fan throws 6 times as much air across the cylinders.

You Get Lower Maintenance because the valves are exclusive Worthington Feather* Valves; lubrication is controlled; bearings are famous Timken roller bearings, including oversize main bearings.

You Get Longer Life because the pistons in each stage, though different in size, *weigh alike*, reducing vibration; crankshaft is drop-forged steel with integral counterweights; bearing pressures and piston speed are low.

Your Worthington Air Compressor Distributor has a complete line of single and two-stage models, bare or tank-mounted, ½ to 15 hp.

*Reg. U. S. Pat. Off. PC. 9.6

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
PUMP AND COMPRESSOR MERCHANDISING DIVISION
HARRISON, NEW JERSEY

The Good Right Hand of Industry

POWER TRANSMISSION: sheaves, V-belts, variable speed drives
PUMPS: centrifugal, power, rotary, steam
AIR COMPRESSORS: water-cooled, air-cooled

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Pump and Compressor Merchandising Div.
Harrison, N. J.

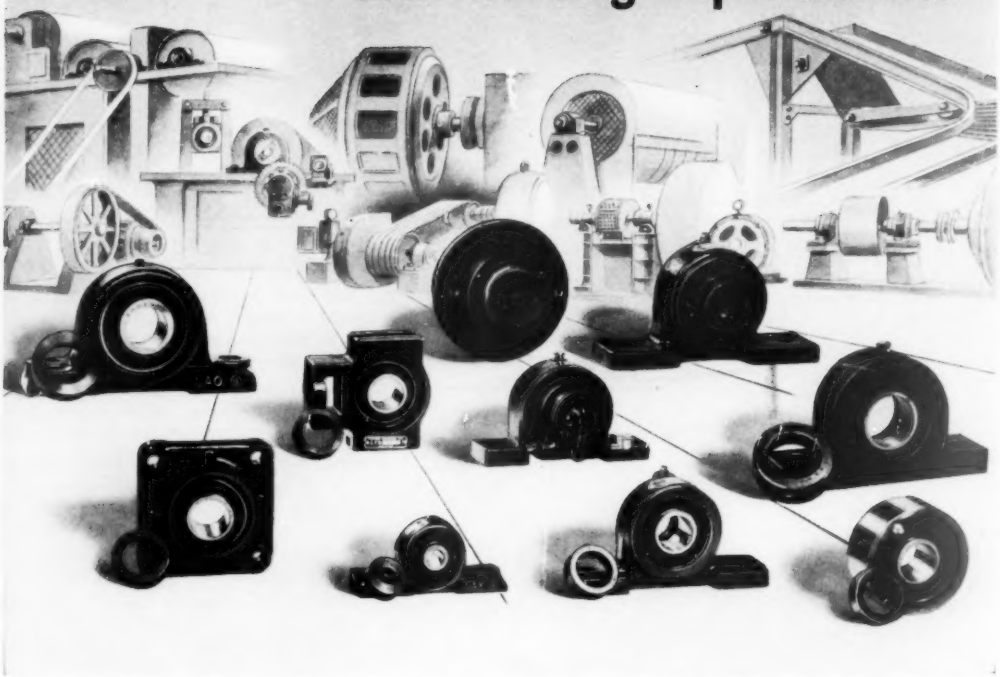
Send bulletin on Worthington Balanced Angle Air Compressor.

Name.....

Company.....

Address.....

NOW'S the time to push cost-reducing improvements



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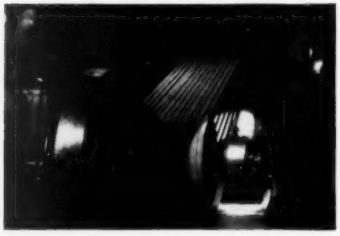

EXAMPLE...

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If you have a let-up in the production treadmill, take advantage of the pause to reduce maintenance costs, save power and speed up machines. This is the time to replace oil-dripping, labor-taking, power-wasting plain bearings with Fafnir Ball Bearing Transmission Units. Time after time, these modern anti-friction bearings have paid for themselves within a single year. Today, call your Fafnir distributor . . . for recommendations, for complete service, for fast delivery. The Fafnir Bearing Company, New Britain, Conn.

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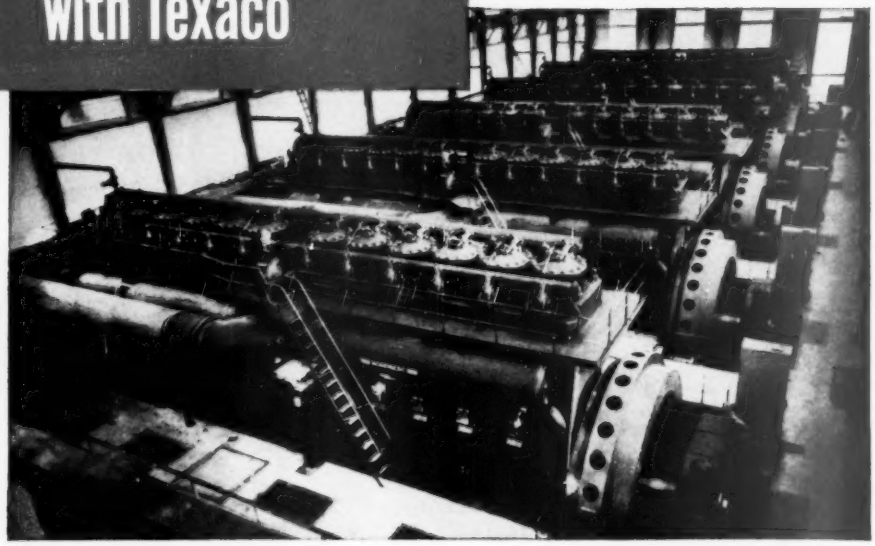
Mexican Light and Power Company, Ltd., lubricates battery of "hemisphere's biggest" Diesel engines with Texaco Ursa Oils.



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FACTORY
MANAGEMENT AND MAINTENANCE
L. C. MORROW, EDITOR

The Place of Output per Man-Hour in a Cost-Cutting Program

EVERYONE WHO SPEAKS of output per man-hour should know what he is talking about. In the interest of accuracy he should give his definition before making any claims.

The assumption by the layman and by the employee is that worker effort alone is being referred to. More times than not, it is. And more times than not, reference should be to the output of the plant, or industry, as measured in some kind of units divided by the number of man-hours worked.

It would be highly desirable if industry would itself think in terms of the formula

$$\frac{\text{Units of Output}}{\text{No. Emps.} \times \text{Hrs. Worked}} = \text{Output per Man-Hr.}$$

Suppose it then thought in terms of what would be required in better equipment or methods to make the numerator of the left side of the equation bigger, while the denominator remained constant. As the numerator grew, the right-hand member of the equation, output per man-hour, would go up.

If the constant denominator could be based upon employee effort that would give a fair day's work, the only limit to the output per man-hour would be management's inability to build better equipment and devise better methods.

Of course it is desirable to reduce the size of the denominator of the left side of the equation when possible. To the extent that workers are not giving a fair day's work, correction is needed. Actually, it would be possible for the worker to reduce his effort, and thereby increase the size of the denominator, to the point where the resulting small output would be an absurdity.

However, maybe the worker doesn't know any better than to deliver something less than a fair day's work. My fellow-workers in the machine shop used to tell me to slow down, because if I didn't I'd be killing the "premium." I'm afraid there was some justification for their attitude. Then in periods of little work, I was an apt pupil when told to drag out what I had.

Some Things Management Ought to Do

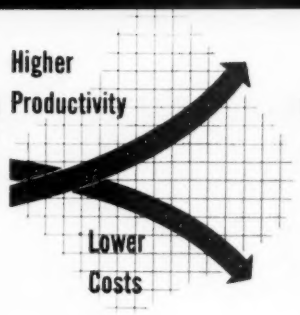
Yes, there is something to be said about management's responsibility: First, to have a policy about not killing the premium (thank goodness, most management does); and second, to have a policy on what to do about workers when business gets bad.

Then there has to be some continuous method of keeping the worker informed of and sold on those policies. Otherwise he isn't going to be too likely to hump himself on the theory that the more he turns out, the lower will be the production cost of what he is making; and that the lower the cost of production, the lower the selling price, the more the customers will buy, and therefore the more secure his job—all of which is true.

But the emphasis, in thinking, talking, and acting, relative to output per man-hour should not be on manual effort. The big opportunity after the worker gives a fair day's work, lies in management's ability to improve the equipment and methods which are the tools the worker uses. A man with a sledge can drive a pile if he works hard enough and long enough. But a man with a pile driver—

L. C. Morrow

THE THIRD



ARTICLE IN FACTORY'S

Carry Out a Methods

1 IMPROVING METHODS is the quickest and easiest way to start cutting costs

2 PRINCIPLES involved are: Eliminate, combine, change, simplify, and sell the personnel affected

3 PRACTICES that virtually guarantee success are simple and are the same for a company-wide program or for a one-man campaign

ALLAN H. MOGENSEN • CONSULTING EDITOR, FACTORY

COST REDUCTION has always meant just one thing to me—*elimination of waste.* Waste of time. Waste of energy. Waste of materials.

Waste steals profits and endangers wages. Make it easier for the operator not to make waste—and you have taken the first big step to *bear down on production costs.*

To eliminate waste, we must do things the right way. The right way of doing anything is an art. But unfortunately we don't always do things the right way—because that means we must do some thinking.

When time is really vital, we learn to save it. Remember the horsedrawn fire engine? Motion economy and time-saving details were worked out to the *n*th degree in the firehouse. Pre-positioned harnesses. Sliding poles from upper floors. A superb example of a place for everything and everything in its place.

Why? Because the firemen had to get off to the fire in the quickest possible time. It could always be a matter of life and death.

Our problem is to generate similar interest and enthusiasm among our employees. The life of our company—and therefore our personal welfare—depends on reduction of waste. Fundamentally, we can sell our customer only the work that adds value to the product.

Frederick W. Taylor once said that the art of management is knowing exactly what you want men to do, and then seeing that they do it in the best and cheapest way.

Do you always know exactly what you want your men to do? If you do not have the facts, you cannot evaluate or measure the various factors in the job. And you cannot arrive at a correct solution. You do what's too often done. You make a flash improvement, based on shop judgment.

Lord Kelvin put it like this:

"If you can measure that of which you speak, and can express it by a number, you know something of your subject. But if you cannot measure it, your knowledge is meager and unsatisfactory."

Exact information implies the use of measurement. No definite or permanent advance is ever made in any kind of work, whether with men, materials, or paper forms, until use is made of measurement. This is especially true of advancement of the human factor. It varies so widely that, unless we use measurement and abide by the results, there is no possibility of repeating the process accurately and efficiently at will, or of predicting and controlling the future conditions which assure that advancement.

To be sure that we do not make flash improvements, I find it necessary to follow a pattern. My pattern is a very simple one. I've been using it successfully for many years in my work simplification programs. It has five steps:

1. **Pick a job to improve.**
2. **Make a process chart.**
3. **Challenge every detail.**
4. **Work out a better method.**
5. **Apply the new method.**

Let us now discuss these five steps to methods improvement as well as we can in this short article.

Improvement Program

1. Pick a Job to Improve

The things that need improvement are not always apparent. It is easy to walk by the same bad situation day after day without seeing it. Look for bottleneck jobs. Jobs that take too much time. Jobs where costs are high. Jobs that require chasing around for materials, tools, and supplies. Jobs, obviously, where the possibility of making substantial dollar savings, both now and in the future, is great.

There is a good discussion of this problem of picking the job to improve in the first installment of this Bear-Down-on-Production-Cost Series ("How to Organize for Cost Reduction," May, page 66).

2. Make a Process Chart

In order to analyze a complete process, it must be recorded detail by detail in the order in which it happens. Then you can successfully think about it.

We cannot make movies of every job, but we *can* use a "still-picture" technique. We can use a job breakdown in chart form. There are three such charts—flow process chart, multiple activity process chart, operator process chart. The first emphasizes *distance;* the second, *time;* the third, *individual motions* of the person doing the job.

These charts have been used many times to illustrate FACTORY articles. So I am going to describe only the flow process chart here. It is the simplest of the three, and the principles involved in its construction are the same for all three. Many firms, of course, prepare special forms for making flow process charts. While details vary, the basic elements remain the same. A good example is found on page 71.

The flow process chart is made by following men, materials, or paper forms through the entire process. It shows the route of the object followed from the beginning of the process to the end. First developed by Frank Gilbreth, and used by him in many phases of management work, its value has been definitely proved. To make such a chart:

1. State the activity being studied. Be sure you are really breaking down the job you intended to break down.

2. Choose the subject to follow. Stick with it. Pick a person, material, or paper form, depending on which goes through the entire process you are working on. When you have picked the subject, don't change. Each detail must be on that subject.

3. Pick a starting and an ending point. This is to be sure you cover the ground you want to cover, but no more.

4. Write a brief description of each detail. Step by step—no matter how short or temporary—every operation, every move, every storage, and every inspection must be indicated. To list every detail, make the chart on the job as you see it done.

5. Apply the symbols. The description determines whether to use the symbol for operation, transportation, delay, storage, or inspection.

6. Black in the "do" operations. Every job is made up of *make ready, do,* and *put away. Make ready* is the effort and time put into setting up equipment or machines, or getting materials with which to work. *Do* is the actual work done—usually that which adds value to the product. *Put away* is the clean-up following the *do.*

7. Enter distance—in feet, every time a transportation occurs.

8. Add time, if required. Often the time element is not needed in order to develop a better method.

9. Summarize. Add up all facts and put them in the summary block. The summary indicates total number of operations, transportations, delays, storages, and inspections.

We have all had the experience of watching a specific job for 30 minutes or more and realizing afterwards that we had observed things which had never before been brought to our attention. *This is our key point.* While the chart is being made, each of those details is recorded in black and white, on the spot. No alteration can be made later.

To sum up, then, the flow process chart is a valuable tool because (1) it breaks down the process into its simple, individual details; (2) the *make ready*, *do*, and *put away* elements are clearly indicated; (3) as a "still picture" the chart separates the job from its background and surroundings; (4) its condensed form enables us easily to visualize the process in its entirety; (5) through the mere act of making the close observation required to draw up the chart, ways and means of making improvements will be developed.

3. Challenge Every Detail

We now have a flow process chart of the present method. So we are ready to study it for possible improvement. Challenge every detail of the job. Put it "on the stand." Ask it pointed quesions:

1. WHAT? What is done? What is the purpose of doing it? WHY is it done? These questions determine the value or useful purpose of doing the particular detail being considered. We want to know if it does what it is supposed to do.

2. WHERE? Where is it being done? Where is the best place to do it? WHY should it be done there? Where else could it be done? These questions are asked to be sure that, if the detail is necessary, it is done in the right place.

3. WHEN? When is the detail done? When is the best time to do it? WHY should it be done then? If the detail is necessary, we must be sure it is done at the right time. Should it be done at the same time as some other detail? Should it be done before—or after—some other detail?

4. WHO? Who does the detail? Who should do it? WHY should this person do it? Can people with lesser skills do the job? Be sure the right person is doing the work.

5. HOW? How is the detail performed? WHY is it done that way? Can we make it easier to do and safer both for the people who do it and for the equipment they use?

These questions are listed in definite order. Ask them in that order. If any question asked of a detail fails to bring a satisfactory answer, make a check mark or a note on your chart to help you develop a better method.

First challenge the whole job that is being studied. Why is it done? Then question each *do*, because every time you eliminate a *do* you also eliminate the *make ready* and *put away* that go with it.

This questioning attitude develops a point of view that considers the good of the whole operation rather than that of any one department or individual. It eliminates useless and unnecessary work which adds no real value to the product. It brings to light the best type of operator and equipment needed. It determines where the work can be most economically performed. And it evens out the flow of work. By challenging each step, you often discover that a part of the work—sometimes the whole work—is not necessary at all.

Above all, get rid of *make ready* and *put away*. Concentrate on these two bugaboos. Every time work is done that doesn't bring the end-result closer, we have waste—waste of time, waste of energy, waste of material.

At the end of the challenging, you will have some unanswered questions concerning certain details. There may be several possibilities. So far, they are only possibilities. Now they must be worked up into a new method.

4. Work Out a Better Method

Again we ask some searching questions. Can we eliminate? Can we combine? Can we change the sequence? Can we change the place? Can we change the person? Can we improve?

Can we eliminate? Too often we give a lot of time to studying operations for improvement possibilities without asking: "Why do we perform this operation?"

Dr. Lillian Gilbreth once said: "Entirely too many operations are studied that never should be done at all."

This first question should not be abandoned until every possible effort has been made to eliminate the operation. This is not an easy task, especially if the person or persons who are attempting to eliminate the operation are intimately familiar with it or have been doing it for some time. It is precisely for this reason that the viewpoint of the outsider is so valuable when new methods are being considered and the work of developing them is under way.

Ability to ask *why?* is often responsible for the outsider's success. He naturally asks *why?* at each step—and all too many answers boil down to "Well, we have always done it this way." If that is the only reason that can be given, it certainly should be questioned. A well-known production man once told me:

"If I find one operation in my plant has been done the same way for six months, I feel it should be questioned. If I find it has been done the same way for a year, I know damn well it is wrong."

The flow process chart enables you to take the outside viewpoint. It enables you to stand off a little way from the operation. It gives you a bird's-eye view. There is no better way to picture the whole integrated operation of a plant than to have complete process flow charts in front of you.

First and easiest of the symbols to challenge are the transportations and the storages. Whenever you see a part carried an appreciable distance, the question *why?* immediately suggests grouping of equipment to eliminate this travel.

Question every single handling. If handling is absolutely necessary, then look for (1) backtracking of work, (2) heavy lifting or carrying, (3) trucking, (4) bottlenecks, (5) skilled operators doing handling.

Then try to use all mechanical means possible. Keep material moving in one direction. Use proper loading, unloading, and stacking.

Can we combine? Don't overlook this opportunity for improvement. Wherever two operations can be combined, they are often performed for the labor cost involved in only one of them, or even less. Also, all transportations and storage between the operations are eliminated.

Combining operations often results in improving quality, may eliminate unnecessary inspections.

If operations cannot be combined, ask if it is possible to combine a transportation and an operation. Until recently most production men thought that if an object was being moved, say, from one conveyor line to another, the best they could do was provide a mechanical means of transportation. Even this good practice is now being questioned. Oftentimes a touch-up or finishing operation can be performed while moving from one location to another.

Many inspections can be combined with operations. When we inspect, it usually means taking the piece out of one container and returning it to another. Usually this follows or precedes an operation. By combining the inspection with one of the operations, you eliminate the extra handling.

Can we change the sequence? If parts of the job cannot be combined, perhaps you can do them in different sequence. The flow diagram or templet layout of the department or plant will help you decide. By changing the sequence of an operation, you may be able to eliminate backtracking. Sequence of operations is largely determined by the process—but often changes can be made with consequent saving.

Can we change the place? Why is it done there? Could it be done better some other place? Why not? Too often work is done in one place or department mainly because it has always been done there. Or because the building of little kingdoms has prevented its being moved elsewhere.

Can we change the person? Challenging with the question *who?* often results in the discovery that the operation could be done to better advantage by some other person. "Who inspects this item?" "The inspector, of course." "Why?" Perhaps the inspection could be done by the operator without a lot of re-handling. Stick to the question until it has been shown that no other person can do the detail better.

Can we improve? Finally, if no change in sequence, place, or person can be made, we ask this last question. Unfortunately this is where many attempts to improve methods *start*. Many a departmental layout is made on the theory that, by taking a few of the key operations and putting them on more modern equipment, with slight rearrangement, a proper layout will result. All this is merely shifting over all the bad methods into a new location—with some slight savings. If the job were done thoroughly, the return on the investment might be several times that secured through rearrangement alone.

To simplify work, then, *eliminate* unnecessary details; *combine* details when practicable; *change* for a better sequence, place, or person; *improve* all necessary details.

5. Apply the New Method

Before actually ordering any revision of the present method, check your proposal carefully. Be sure nothing has been overlooked. Review your plan with all supervisors who may be affected.

Two major problems must be considered in putting the new method into operation. They are the technical problem and the human problem.

The technical problem. Will it reduce costs? Will it increase production? Will it improve quality? The cost of installing the improvement must be weighed against any ultimate savings in operation cost. Is it a "good buy" for the company? Since new equipment is usually expensive, concentrate on better utilization of existing facilities.

Finally, present the plan in a clear and concise manner. Allow no doubt as to benefits to be derived. This is best done by using the process chart showing present and proposed methods worked out in detail.

The human problem. Every time a method is changed, workers are affected. Remember, there are two big difficulties in dealing with people.

First, people resist what they don't understand. To offset such resistance, explain and demonstrate, if possible. Solicit the ideas and suggestions of those working with you and for you.

Second, people naturally resent criticism. Do not criticize. Be certain that your presentation does not imply criticism.

In working out the improved method, discuss the jobs with the workers involved. Tell them in advance of changes that may affect them. Explain *why*. Develop joint participation. This is all part of "selling the operator," and it is just as important as selling the boss.

A test or trial run is sometimes advisable. This, too, helps to sell the new way to the worker and insures against upsetting regular routines when total application is decided.

Do not overlook safety regulations and working conditions.

Follow through. Once the new installation is made, be sure maximum benefits are obtained. Keep the methods going—but be receptive to any *new* improvements that may develop.

Above all, be sure to give credit to those responsible for recommending a better method to improve your method. It means so much and costs so little.

CASE STUDIES. Beginning on pages 70, 78, and 84 are reports of three successful methods improvement programs

HOW THREE COMPANIES ARE CUTTING COSTS THROUGH METHODS IMPROVEMENT • CASE 1

Putting 105 Men to Work on Cost Reduction

CHARLES WINKELMAN • CHIEF INDUSTRIAL ENGINEER BELDEN MANUFACTURING COMPANY, RICHMOND, IND.

AN ALL-OUT ATTACK ON COSTS was the aim of a modern work methods program recently completed at Belden's Richmond plant. This program, which provided a systematic approach for analyzing operations, with a view to eliminating or combining them wherever possible, and for developing and installing new methods, is expected to double the dollar volume of cost reductions. That this is an ambitious goal may be readily seen when it is revealed that last year's accomplishment resulted in reductions of more than $200,000 in product cost.

Preparing for a Buyers' Market

We have been preparing for the change from a sellers' to a buyers' market for a long time. But the continued increase in the cost of labor, materials, and services convinced us that a new approach to cost reduction would be necessary. With small variances in cost assuming greater importance each day, it may be readily understood why we are stepping up our continuing search for better utilization of materials and for more efficient manufacturing methods.

Let's not give the impression that Belden is just becoming "cost conscious." On the contrary, it has long been our practice to carry on a four-pronged attack on costs through the engineering, manufacturing, industrial engineering, and suggestion departments.

The engineering department is primarily responsible for reducing costs through product design, setup for manufacture, and improvement of operations in which manufacturing difficulties are encountered.

The manufacturing departments are vitally concerned with reducing indirect labor and controlling scrap, and help develop better methods.

The industrial engineering department is primarily concerned with establishing efficient manufacturing methods, improving manufacturing costs through plant layout, and reducing the costs of production control and similar procedures.

The suggestion department, for its part, provides a channel by which all employees can submit and obtain recognition for ideas on methods improvements that have occurred to them on the job.

But—this was not enough.

Good as were the results obtained by these four groups working cooperatively with one another and with the shop organization, there was still a large untapped reservoir of know-how in nontechnically trained management personnel capable of being turned loose on cost reductions. It was felt that if a completely cost-conscious attitude could be stimulated in this large group, the unleashed power available for a cost reduction drive would produce far greater results. But there were stumbling blocks in the way of this program:

1. Although the individuals who were to take part in the program were entirely familiar with manufacturing procedure and with our general operations, they were not too familiar with the techniques of methods improvement analysis.

2. Even if they had been acquainted with analysis techniques, they were extremely busy with their own jobs, and did not have the time to find out what calculations were required to permit proper evaluation from a cost standpoint, or how to present their findings for approval.

A Program for Cost Reduction

It was obvious that it would be futile to launch a program to interest all levels of management in reducing costs unless they were at the same time presented with a complete package of systematized instructions on how to do it.

Because of this need, a cost reduction program was developed with the following basic steps:

1. Analysis of the present method.

Forms used are shown on the following pages. The text is continued on page 75

RIGHT—AND LEFT—HAND OPERATION ANALYSIS CHART

SUBJECT	TAPPING HEATER CORD CONNECTOR
LOCATION	Punch Press Dept. — ANALYSIS NO. 1
DETAILS	Hand operated drill press with reversing tapped head. Part held by hand in fixture. One part/cycle. — METHOD: PRESENT / PROPOSED
SHEET	1 OF 1 — BY D.R. — DATE 4-48

SYMBOLS: ○ OPERATION ○ MOVE ▽ STORAGE □ INSPECTION

	LEFT — HAND DESCRIPTION	SYMBOL	RIGHT — HAND DESCRIPTION
1	Pick up connector from left side of table	○	▽ Hold drill press lever
2	Look for face position	○	
3	turn up while carrying		
4	to fixture		
5	Place in fixture	○	
6			
7	Hold in fixture	▽	○ Lower lever and tap
8			
9			
10			
11			
12			
13			○ Raise lever
14	Remove from fixture	○	
15			
16	Lay aside on right	○	
17	side of press table		
18			
19			SUMMARY
20			3 - ○ - 2
21			2 - ○ - 0
22			1 - ▽ - 1
23			1 - □ - 0
24			
25	Time per cycle - .0667 minutes		

1 Right- and left-hand operation analysis chart is used first to break down present method into its components, and then to develop new method. Problem selected here is the simple one of tapping heater cord connectors

PROCESS ANALYSIS CHART

SUBJECT	HEATER CORD CONNECTOR ASSEMBLY
LOCATION	Punch Press Dept. — ANALYSIS NO. 1
DETAILS	Assemble SP-222 Brass Part SP-223 Steel Part and Brass Screw — METHOD: PRESENT / PROPOSED
SHEET	1 OF 1 — BY G. Hill — DATE 4-13-48

SYMBOLS: ○ OPERATION ○ MOVE ▽ STORAGE □ INSPECTION

TIME	TRAVEL IN FT	SYMBOL	STEP NO.	DESCRIPTION
		SP-223 SP-222		
		○	1	Assemble AP-222 & 223 on #1/2 Toledo Federal press. Drop delivery, small tote pans.
		□	2	Process inspection of spring tension.
	8	○	3	To tapping machine, Carried by operator.
		□	4	Tap #5x40 machine thread. Loaded in small tote pans.
		□	5	Process inspection of machine thread.
Mach. Screw	40	○	6	To screw assembly machine by operator.
		□	7	Assemble screw. Drop delivery in small tote pans.
		□	8	Process inspection for loose screws.
	40	○	9	To temporary storage area by general man.
		▽	10	Temporary. Accumulate for large tote pan quantity.
		○	11	Dumped in large tote pan by general man.
		□	12	Weight count for billing.
		□	13	Final inspection.
		□	14	Load tote pans on 4-wheel truck.
	273	○	15	To stores dept. Truck pushed by general man.
		▽	16	Permanent until requisitioned.

SUMMARY

○ - 5 ▽ - 2 ○ - 4 □ - 5

Travel in feet - 361

2 For a long operation or group of operations, or where it is desirable to analyze what happened to material, the process analysis chart is used. The example of the heater cord connection is continued. This chart is not necessary for many operations

PRODUCT COST CHANGE WORK SHEET

SUBJECT	REPORT NO.	DATE
PA-5 HEATER CORD CONNECTOR TAPPING OPERATION	I	7/15/48
		SHEET OF

DATA

ITEM	OLD COST SYM-BOL	OLD COST FIGURES	NEW COST SYM-BOL	NEW COST FIGURES	ITEM	OLD COST SYM-BOL	OLD COST FIGURES	NEW COST SYM-BOL	NEW COST FIGURES
MATERIAL COST PER 100 UNITS	A	$ 0	E	$ 0	OVERHEAD PERCENTAGE OF LABOR	H	150 %	L	150 %
LABOR COST PER 100 UNITS*	B	$ .133	F	$ .0418	BURDEN COST PER HOUR	J	$	M	$
SCRAP ALLOWANCE PERCENTAGE	C	1.5 %	G	1.5 %	PRODUCTION PER HOUR	K		N	
ESTIMATED ANNUAL PRODUCTION	D	1,272,000			NOTE: ENTER DATA EITHER IN OVERHEAD BOX OR BURDEN AND PRODUCTION PER HOUR BOXES DEPENDING ON METHOD OF ABSORBING EXPENSE.				

*IF INCENTIVE STANDARD IN MONEY HAS NOT BEEN ESTABLISHED COMPUTE LABOR COST ON REVERSE SIDE.

COST PER 100 UNITS

ITEM	OLD COST SYM-BOL	OLD COST FORMULA	OLD COST FORMULA FIGURES	OLD COST FORMULA RESULTS	NEW COST SYM-BOL	NEW COST FORMULA	NEW COST FORMULA FIGURES	NEW COST FORMULA RESULTS
OVERHEAD	P	B x H	.133 x 150%	$.200	S	F x L	.0418 x 150%	$.0627
BURDEN		J / K/100		$		M / N/100		$
MATERIAL, LABOR AND OVERHEAD OR BURDEN	Q	A + B + P	0 + .133 + .200	$.333	T	E + F + S	0 + .0418 + .0627	$.105
SCRAP	R	Q x C	.333 x 1.5%	$.0050	U	T x G	.105 x 1.5%	$.0016

ITEM		SYM-BOL	FORMULA	FORMULA FIGURES	COST CHANGES DECREASE	COST CHANGES INCREASE
MATERIAL CHANGE	PER 100 UNITS	V	A − E		$	$
	ANNUAL	W	V x D/100		$	$
LABOR CHANGE	PER 100 UNITS	Y	B − F	.133 - .0418	$ .0912	$
	ANNUAL	Z	Y x D/100	.0912 x 1,272,000/100	$1160.06	$
OVERHEAD OR BURDEN CHANGE	PER 100 UNITS	a	P − S	.200 - .0627	$ .137	$
	ANNUAL	b	a x D/100	.137 x 1,272,000/100	$1742.64	$
SCRAP CHANGE	PER 100 UNITS	d	R − U	.0050 - .0016	$ .0034	$
	ANNUAL	e	d x D/100	.0034 x 1,272,000/100	$ 43.25	$
ANNUAL COST CHANGE TOTALS FOR DECREASES AND INCREASES		f	W + Z + b + e		$2945.95	$
TOTAL ANNUAL COST NET CHANGE			SUBTRACT INCREASE OF LINE f FROM DECREASE OF LINE f		$2945.95	$

SUPPLEMENTARY DATA

Note: Arbitrary figures used for illustration.

3 Data relating to material cost, labor cost, scrap allowance, estimated annual production, and overhead (as a percentage of labor) are collected on a product cost change work sheet. This analysis protects against the possibility of adopting a new method that would actually be more expensive

COST AND METHOD IMPROVEMENT PROPOSAL

SUBJECT	LOCATION	PROPOSAL NO.
PA-5 HEATER CORD CONNECTOR TAPPING OPERATION	Punch Press Section	1

DETAILS: Tap #5-40 threads in PA-5 heater cord connectors on drill press equipped with reversible tapping heads

ANNUAL COST CHANGES		
ITEM	DECREASE	INCREASE
MATERIAL	$	$
LABOR	$1,160.06	$
OVERHEAD OR BURDEN	$1,742.64	$
SCRAP ALLOWANCE	$ 43.25	$
TOTAL COST NET CHANGE	$2,945.95	$

ESTIMATED ANNUAL PRODUCTION: 1,272,000

BASIS OF PRODUCTION ESTIMATE: Actual production figures for first six months of 1948

ESTIMATED COST OF IMPROVEMENT		
LABOR	EQUIPMENT	TOTAL
$ 20.00	$175.00	$195.00

IMPROVEMENT COST ABSORPTION TIME			
LABOR		TOTAL COST	
YEARS	MONTHS	YEARS	MONTHS
	2		1

SUPPORTING DATA		
R & L HAND CHARTS		✓
PROCESS ANALYSIS SHEETS & CHARTS		
FLOW DIAGRAMS		
DRAWINGS		✓
ACTIVITY CHARTS		
WRITTEN REPORTS		
PRODUCT COST CHANGE	WORK SHEETS	✓
	SUMMARY SHEETS	
SPECIAL COST CHANGE WORK SHEETS		
OTHER		

IMPROVEMENT GAINS OTHER THAN COST CHANGES

1. Increased productive capacity will make possible meeting increased schedule requirements without the purchase of additional drill press.
2. Decreased operator fatique.
3. Increased capacity without an increase in floor space.
4. Increased capacity without hiring and training additional operator.

IMPROVEMENT DETAILS

1. With present method operator picks up, places, and holds one part in fixture with left hand. Right hand operates lever to raise and lower tap. Operation is performed on one head of a three-head drill press.
2. With proposed method a second tapping head will be installed on one of the unused drill press heads. Operator will pick up one part with each hand, and place in fixture guide. Operator will slide connectors under tapping heads, at same time pushing previously tapped connectors into tote box. Parts will then be tapped by operating foot pedal while operator reaches for parts for next cycle.

DEVELOPED BY	ASSISTED BY	IMPROVEMENT SUGGESTED BY
J. Hodowal	V. Cutler	W. A. Rudolphsen
DEPARTMENT: 31	DATE: 7/15/48	REPORT CHECKED BY

PROPOSAL STATUS RECORD	ACCEPTED	REJECTED	RETURNED	HELD

4 Rapid evaluation of proposals is possible by referring to the cost and method improvement proposal sheet. Improvement cost absorption time is always indicated, and gives management a good basis on which to determine advisability of making the appropriation required for the installation of the new method

Continued on next page

COST AND METHOD IMPROVEMENT ACCOMPLISHMENT REPORT

SUBJECT	LOCATION	REPORT NO.
PA-5 HEATER CORD CONNECTOR TAPPING OPERATION	Punch Press Section	1

DETAILS: Tap #5x40 threads in PA-5 heater cord connectors on drill press equipped with reversible tapping heads

ANNUAL COST CHANGES		
ITEM	DECREASE	INCREASE
MATERIAL		
LABOR	$1,240.20	
OVERHEAD OR BURDEN	1,866.02	
SCRAP ALLOWANCE	47.06	
TOTAL COST NET CHANGE	$3,153.28	

DATE EFFECTIVE: 7/15/48

ESTIMATED ANNUAL PRODUCTION: 1,272,000

BASIS OF PRODUCTION ESTIMATE: Actual production figures for first six months of 1948

IMPROVEMENT COST: $195.00

IMPROVEMENT COST ABSORPTION TIME

LABOR		TOTAL COST	
YEARS	MONTHS	YEARS	MONTHS
	2		1

SUPPORTING DATA

WRITTEN REPORT		
COST FIGURES	PRODUCT COST CHANGE WORK SHEETS	✓
	PRODUCT COST CHANGE SUMMARY SHEETS	
	SPECIAL WORK SHEETS	
OTHER		

IMPROVEMENT GAINS OTHER THAN COST CHANGES

1. Increased productive capacity will enable meeting increased schedule requirements without the purchase of additional drill press.
2. Decreased operator fatigue.
3. Increased capacity without increase in floor space.
4. Increased capacity without hiring and training additional operator.

IMPROVEMENT DETAILS

Old Method

1. Operator picked up, placed, and held one part in fixture with left hand.
2. Right hand operated lever to raise and lower tap.
3. Operation was performed on one head of a three-head drill press.

New Method

1. A second tapping head was installed on one unused drill press head.
2. Operator picks up one part with each hand and places them in fixture guide.
3. Operator slides connectors under tapping heads, at same time pushing previously tapped connectors into tote box.
4. Parts are then tapped by operating foot pedal while operator reaches for parts for next cycle.

DEVELOPED BY	ASSISTED BY	IMPROVEMENT SUGGESTED BY
J. Hodowal	V. Cutler	W. A. Rudolphsen
DEPARTMENT: 31 DATE: 7/15/48		REPORT APPROVED BY

5 Careful follow-up of all proposals adopted and put to use is provided by cost and method improvement accomplishment report. Report is filed as soon as new method reaches a condition of stable operation from which facts may be clearly established. If other processes have been affected, reports cover them, too

Text continued from page 70

2. Development of the improved method.

3. Computation of the cost change.

4. Preparation of the proposal for obtaining adoption approval.

5. Reporting the accomplishment.

For each of these steps a procedure was devised, built around forms that were designed for recording and reading the essential information in the minimum time. To simplify the procedure, instructions for the use of the forms were printed on the back. Thus the need for dependence on memory or reference to other sources was eliminated.

The procedures devised for the program provided an added incentive to cost reduction effort by:

1. Standardizing and simplifying the processes of developing and proposing improved methods.

2. Insuring careful consideration of each proposal.

3. Assuring the individual who developed the proposal, and all who assisted, of full recognition for their contributions to the cost reduction program.

Organizing the Program

The attainment of the program objectives in such a relatively short period of time was due, we feel, to the organization of the material and to the principles on which the program was based:

1. Participation in the program, so far as was practical, should extend to all levels of management.

2. Program participants should be fully informed as to the long-range importance of the program both to themselves and to the company.

3. The training aspect of the program should take a minimum of the participant's time.

4. The instruction pattern should be such as to appeal to a practical shop man. (This was accomplished by the elimination of textbooks and quizzes.)

5. Each participant should understand that success in reducing costs is dependent upon ability to solve problems; the program should provide a systematic plan for the application of the principles of problem solving.

Training in Better Work Methods

The training aspects of the program were divided into six sessions of two and one-half hours each. The basic training in improving methods was given in the first three sessions on successive days. The application of program procedures to plant problems was started after the third session. In order to provide sufficient time for working on cost reduction problems, the remaining three sessions followed each other at bi-weekly intervals.

Invitations to participate in the program were extended by the plant manager to 105 members of management—approximately 10 per cent of the total plant personnel. Those invited to attend included shop foremen, supervisors, department heads, engineers, inspectors, and staff members who could in any way aid in cost reduction work. In addition, the plant manager attended and participated in the program.

At the beginning of the program's second training session, each participant was provided with a portfolio containing an initial supply of forms. It was also the intention that additional procedure forms and example sheets, distributed in later sessions, should be filed in the portfolio so that each participant would have all cost reduction aids in one place.

Program Content

The following points were covered in the sessions:

Session 1

a. Introduction by the plant manager.

b. Importance of cost reduction to the participant and to the company.

c. Statement of the program objective: "to reduce costs by teaming up job know-how with an effective procedure for improving methods."

d. Outline of the supervisory responsibilities of participants and how these obligations could be better discharged through methods improvements.

3. Sample cost reduction problem of the "before" stage of a manufacturing operation presented on movie film. Members asked [illegible] record the details of the operation and [illegible] improvements.

Session 2

a. Report of the various individual approaches uncovered in the problem analyses made on the previous day. Based on the variance disclosed in these approaches to solving the particular cost reduction problem, the need was outlined for an organized method of observing problem details and a reliable method of solving problems.

b. Procedure introduced for making right- and left-hand operation analysis.

c. Re-analysis made of the cost reduction problem introduced in Session 1, using the program procedure for right- and left-hand operation analysis.

d. Group instructed in the use of right- and left-hand analysis chart in the development of the improved method.

e. Movie film shown, illustrating how the problem was solved in actual practice.

f. Review of the two approaches to solving the cost reduction problem: (1) the individual approach of the members; and (2) the systematized approach introduced in the program.

Session 3

a. Various applications of right- and left-hand analysis pointed out.

b. Participants introduced to the program's procedure for process analysis.

c. Simple operations, such as examining a book, performed by selected group members while the group made a process analysis of the operation.

d. Participants asked to make an analysis of an operation or of a process, using the program procedures, before the next session.

Session 4

a. Applications for process analysis outlined.

b. Analysis of flow of materials explained.

c. Experiences of group members in the use of the program's analysis procedures discussed.

Continued on next page

Session 5

a. Procedure introduced for computing product cost and methods improvements.

b. Entire program and its systematized procedures reviewed.

c. Cost and methods improvement proposals made by program participants reviewed.

The Systematic Approach

As was stated earlier, forms to cover each step in the procedure of solving cost reduction problems were designed to standardize the steps involved. To show how the various forms are used in solving cost reduction problems, let's examine the problem that served as an illustration during the training period.

The problem is that of tapping heater cord connectors. In the old method the connector was tapped on a three-spindle drill press. The fixture for holding the connector was fastened to the table of the press under one of the spindles. The tap was held in the chuck of a pneumatic reversible tapping head which was operated by a foot and lever attached to the spindle.

Operation Analysis

Following the initial attempts of the group to analyze the operation without the use of a systematized approach, the use of right- and left-hand operation analysis charts was thoroughly explained. Figure 1 shows the analysis of the tapping operation described above.

In the new method developed for tapping heater cord connectors, a second tapping head was attached to one of the idle drill spindles, and the third drill press head was removed from the machine. The tapping heads are lowered together by a foot operation. A foot rest is provided to reduce operator fatigue. A new fixture making it possible to tap two connectors at one time was made and attached to the drill press table. Guideways were milled in the surface of the fixture so that the operator can use both hands to slide connectors under a part of the fixture which holds connectors while they are tapped. A tote pan containing untapped connectors is placed on the drill press table to the left of the fixture. As the untapped connectors are moved into tapping position, they push the tapped connectors through an opening in the center of the fixture for drop delivery to a tote pan held in a bracket on the right side of the table.

It was pointed out to participants that since we are not always in a position to install proposed improvements without obtaining the approval of others, our ability to sell others on an idea is *just as important* as the idea itself. The operation analysis charts present all the pertinent details and their relative importance in an organized manner, and so help us in the selling job by taking discussion out of the realm of opinion and putting it on a factual basis. This simple, factual method of presentation requires a minimum of the approver's time to discuss and act upon the suggestion. Hence these operation analysis charts also give us confidence when trying to convince others.

Process Analysis

For a long operation or a group of connected operations, and for cases where it is desirable to analyze what happened to the material, we introduced the process analysis chart (Figure 2). For purposes of continuity in illustration of the procedures the filled-in example in this figure was made for a series of operations in which the heater cord connector tapping operation was included. In the instructions given on the proper development of a process chart, it was emphasized that it was more important to record all of the steps in the operation on the chart than it was to get the symbols for the steps exactly right. Wrong symbols could be caught during the analysis phase and corrected; omitted steps might never be caught.

It should be clearly understood, as it was by program participants, that not all methods improvement ideas require use of the operation and analysis forms. Examples of cases in which they need not be used are a reduction in cost affecting material only, or the complete elimination of an operation.

Cost Computation

Probably one of the most difficult aspects of methods improvement analysis is the problem of computing the dollar savings. Because of the many factors that must be taken into consideration—materials, labor, scrap, annual production, factory expense (overhead or burden), and the actual methods of payment for labor on the particular job involved—the task is complicated even for those to whom such computations are part of the day's work. Previous experience gained in instructing methods men in making cost computations and in laboriously checking the accuracy of cost changes initiated by them indicated the need for a systematized method of computing cost changes.

Nor was this the only problem. In the absence of a simplified method of calculating cost changes, the tendency in many cases was to attempt to force through a methods improvement on the basis that it was obviously going to save money and that the exact amount did not actually matter. This was undeniably true in some cases, but in other cases cost factors which did not appear in the analysis of the improved method tended not only to wipe out the savings but also to make the revised method more costly than the original.

To meet all these specifications, the product cost change work sheet shown as Figure 3 was developed. The features of this work sheet are:

1. It is comparatively easy to check the computations for errors.

2. It takes a minimum of time to instruct participants in the method of computing cost changes.

3. It is so organized that if interruptions occur while making the cost change computations it takes a minimum of time to regain the trend of thought.

4. It provides a record of all data and computations, which can be referred to in the future and clearly understood.

5. It reduces to a minimum the amount of work involved in computing a cost change.

6. It reduces errors introduced by misunderstandings of how cost changes should be computed.

(Methods improvements which affect expense material or indirect labor require the use of a special cost work sheet.)

To follow through the calculations in Figure 3, it

is necessary only to understand what data had to be accumulated for the top portion of the form:

1. Material cost. Since the new method involved merely the addition of an extra tapping head on the press, the material out of which the heater cord connector was made was completely unaffected by the proposed change; hence a "$0.00" change in cost of materials.

2. Labor cost. In this case, based on standard data, a new rate was established for the improved method which was calculated to reduce the "labor cost per 100 units" from $0.133 to $0.0418. (Note that for some products the cost might be figured on a lot of 1000, whereas for others it might be figured on a single unit.)

3. Scrap allowance. Scrap allowance provides for production that is rejected and cannot be salvaged. It is allowed not only on material but also on the labor and overhead expended on the scrapped parts. In this case, since there was no material change, the cost change for scrap was computed on labor and overhead only. This method change did not affect the ratio of scrapped to good parts, and so the scrap allowance remains unchanged at 1.5 per cent.

4. Estimated annual production. For this particular part, annual production was estimated in pieces; for other products it might be estimated in feet, pounds, or other units of measurement.

5. Overhead (percentage of labor). For this particular item, factory expense (overhead or burden) is absorbed as a percentage of the labor cost involved. (If the labor cost for operating the drill press for the previous year totaled $4000, while the total factory expenses attributable to that machine were $6000, the overhead attributable to the operation of the machine *for the ensuing year* would be distributed at the rate of 150 per cent of the base labor cost.)

In the event that the factory expenses attributable to the machine were distributed on a cost-per-hour basis, a machine which was costed at $6000 for a year of 4000 operating hours would carry a burden charge of $1.50 per hour. In this case, nothing would be entered under "H" and "L," but $1.50 would be entered under "J" and "M." Also in this case the estimated production per hour would have to be calculated and entered under "K" and "N," because these figures would then form a part of the calculations.

These are all the figures that are required. Computations of the cost change from this point on is merely a matter of substitution of the data called for in the formulas below the data section.

Method Improvement Proposal

The cost and method improvement proposal sheet (Figure 4), supplemented by supporting data, enables a reviewer to evaluate a proposal in a minimum amount of time. On this form, for ready evaluation, are entered:

1. Changes in costs that will be effected as a result of the change in method.

2. Cost of making the improvement.

3. Gains expected to result from the method change, other than cost changes.

4. Details of the improvement.

An important aspect of the proposal is the improvement cost absorption time. This indicates the amount of time it will take to return the cost of making the method change, either based on the annual labor saving or on the total annual saving. Thus management can see at a glance the time that will be required for the savings to equal the cost of the improvement or to return the investment.

Methods improvements usually involve an initial outlay of money. Such expenditures, where more than $50 is involved, must be approved before the outlay is made. This represents good practice because there is frequently justification for delaying approval if the cash outlay required is large and is currently more urgently needed for other aspects of the business. Thus it becomes all the more important that proposals be submitted in such a manner as to provide an instantaneous, accurate, and clear picture of the proposal for proper evaluation.

Cost and Method Accomplishment

All methods improvements should be followed up to make certain that the expected results are actually attained, and to provide a basis of ascertaining the reason why, if the results have not measured up to expectations.

All methods improvements that are accepted and put into effect are checked for these factors. This check is made by analyzing the new method after it is in operation and making up a new product cost change report similar to the original made up for the proposal. In the tapping operation described here, it was found that the "labor cost per 100 units" actually decreased more than was originally estimated—from $0.0418 to $0.0355. Thus the total net annual savings were found to have increased from $2945.95 to $3153.28. This change was reported on the cost and method improvement accomplishment report (Figure 5). This report is made at such time following installation as the facts are clearly established. This time may vary from a few days to several months. The accomplishment report, with supporting data, constitutes a final report on whether the new method has actually accomplished what it was expected to accomplish.

It must be recognized that a change in the product, for example, may touch off several changes in the method of manufacture of the product. In such cases, the working up of savings data will require the use of several product cost change sheets, one for each operation. In these cases, to arrive at a final figure for the many changes involved, a product cost change summary sheet (not illustrated) is used.

Immediate Benefits

By the end of the program, methods improvement proposals made by program participants totaled $39,903. These were in addition to proposals normally submitted by personnel whose major responsibilities were working on cost reductions. Of this figure we expect a large number to be approved and installed. Since completion of the program many additional proposals (including one for $25,000) have been submitted, and many more are in the investigation stage. Actual total dollar savings figures on these pending proposals are not yet available.

The most important consideration, however, is that the know-how of 105 men has been turned loose on cost reductions, where only a few were working before. This will make possible far greater savings than have ever been effected in the past.

HOW THREE COMPANIES ARE

CUTTING COSTS THROUGH METHODS IMPROVEMENT • CASE 2

Getting Quick Results from Methods Training

ROBERT W. DECKER • SUPERVISOR, MOTION AND TIME STUDY DEPARTMENT, SAGINAW STEERING GEAR DIVISION, GENERAL MOTORS CORPORATION

A METHODS TRAINING PROGRAM has made virtually everyone in the plant conscious of work-simplification principles at Saginaw Steering Gear. The goal is "completing a better product more economically and more efficiently, and with less effort on the part of the worker."

A 36-hour course for all supervisors involved attending one hour-long session each week. The group for which the course was designed includes: time study engineers, production supervision, tool and process engineers, design engineers, inspectors, maintenance men, materials handling supervision, plant layout men, and top management.

All levels of the management team were mixed in the classes; shop foremen mingled with high company officials. Groups were limited to 25 to encourage "off-the-cuff" discussions at the end of each period. This made everyone feel he was contributing to the class and helped in having specific questions answered.

Instructional Techniques

All conferences were led by members of the methods department. Visual aids—35 mm. slides and 16 mm. films, as well as blackboard diagrams and charts—made the job easier.

Everyone attending the session received a job assignment on one or more of several subjects, such as: flow and process charts, act breakdowns, and movement analyses. Each foreman had to select a job in his department and analyze it for method improvement possibilities before the next class.

Summaries of the material covered, to be retained in the foremen's manuals, were given to each member at the end of the class period.

Results

One of the most important developments evolved from the methods training course is the foremen's suggestion program. Now the supervisors have a system of their own for turning in production improvement ideas.

Foremen submit their suggestions on an improvement form. After approval by the foreman's immediate superior, the methods department investigates the worth of the idea and makes either an acceptance or a rejection recommendation. If accepted, a letter is written to the foreman, with copies to his superior, notifying him of the savings realized.

New men coming in are given the complete program, and those who have finished the course are given periodic refresher sessions.

Typical of the valuable ideas for cutting costs and improving operations stimulated by the training are the ten "better methods" described below:

1. HOOD LIFT

Old Method: In butt-welding steering shaft to worm, operator lifted hood by hand, removed welded assembly, placed next two parts to be welded, dropped hood into position, and reached for controls.

New Method: Hood lifts automatically at end of cycle. Operator simply removes welded assembly, places next shaft and worm into position and reaches for controls. Hood closes automatically.

Result: Output up 48 per cent.

2. LOADING RAMP

Old Method: Operator required to drag loose plate into position each time before loading trucks. Slow, heavy, back-breaking job. Plate would not stay in position.

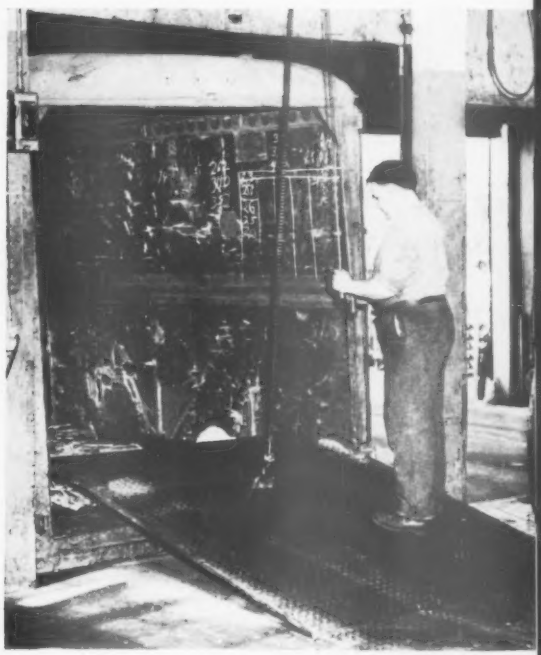
New Method: Hinged plate attached to floor is lifted by small hoist. Plate cannot shift.

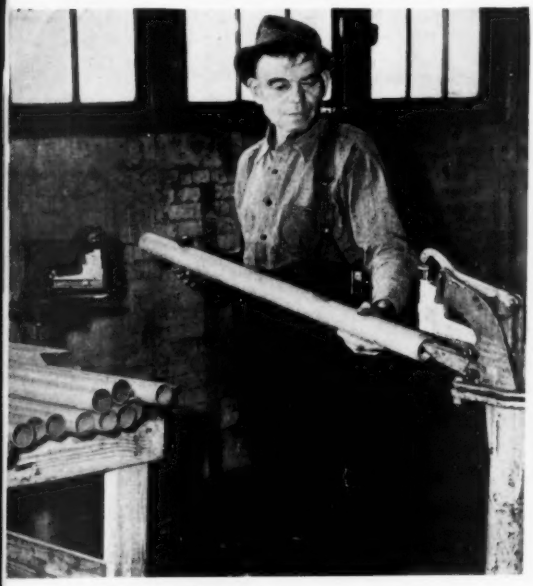
Result: No heavy lifting. Placing time reduced.

Additional examples of methods improvements at Saginaw on pages 80 through 83

1

2





3. TUBE STITCHING

Old Method: Steering shaft assembly was placed in paper tube and held in position by means of paper inserts stapled into ends of tube. Operator placed one end of tube over anvil of foot-operated stitcher and stapled one insert securely. The process was then repeated on other end of tube on a second stitcher.

New Method: Two electrically driven stitchers operated by a single foot button staple both ends of the tube simultaneously.

Result: Output up 61 per cent.

5. BURR REMOVAL

Old Method: As punch pushed through window holes, a burr was left on opposite side. Burr was removed by means of an ordinary file.

New Method: Burring is now combined with a lathe operation on the part. Operator places part on belt sander or upturned grinder head and burring is done during machine time of lathe.

Result: Burring time completely eliminated.

4. BEARING COUNTER

Old Method: Handful of ball bearings for service shipment were picked up in operator's right hand, and 33 were counted out with the left hand. The bearings were then placed in an envelope.

New Method: Simple hopper and slide arrangement automatically counts ball bearings. Slide has 33 holes drilled in it so that one bearing drops into each hole. As slide is pulled forward, bearings drop through the holes and roll down small chute into the envelope.

Result: Output up 259 per cent.

6. GAGE MOUNTING

Old Method: Operator had to gage each cam follower after grinding. Left hand acted as "holder," and machine stood idle while he was gaging.

New Method: Snap gage is mounted on machine bed. Necessary gaging is done with left hand while operator grinds another piece with micro-type feed lever in right hand.

Result: Output up 44 per cent.

Continued on next page

7. SPRING EJECTOR

Old Method: Operator placed seat and housing over pilot on airpress and actuated press by foot pedal. He picked up seat for next assembly with right hand while he removed finished assembly with left hand. Then right hand waited until left hand had also picked up housing for next assembly.

New Method: A spring ejector and metal chute were installed on pilot. The spring pushes the finished assembly off pilot and into chute as soon as ram returns upward. Operator picks up seat and housing simultaneously during working time of press.

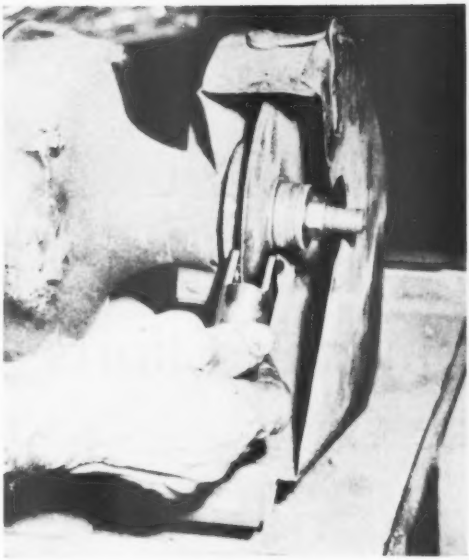
Result: Output up 31 per cent.

9. AUTOMATIC PICK-OFF

Old Method: Bushings and plugs were placed over pilots on an indexing table mounted on a punch press. Parts passed under ram of punch press where plug was expanded into place. Operator removed and disposed of finished assemblies by hand.

New Method: Automatic pick-off attachment was installed on punch press to remove finished assemblies from pilots and drop them into "dispose" chute. Now operator only places plugs and bushings.

Result: Output up 40 per cent.



8. BURRING

Old Method: Each cam follower ear was burred separately on rubber wheel.

New Method: Second rubber wheel, properly spaced beside original wheel, permits burring of both ears simultaneously.

Result: Output up 17 per cent.

10. COMBINED OPERATIONS

Old Method: First operator assembled ball stud to tie rod on air press and dropped it into box. Second operator picked up assembly, placed it into fixture on riveting machine, and hammered ball stud to secure it in assembly.

New Method: Operations now combined. Operator of press places unriveted assembly in riveting fixture. Hammering takes place automatically while a ball stud is being pressed into next tie rod.

Result: Output up 94 per cent.

HOW THREE COMPANIES ARE
CUTTING COSTS THROUGH METHODS IMPROVEMENT • CASE 3

Coordinating Company Efforts to Reduce Costs

ROBERT C. RICK • PRODUCTION MANAGER, AMERICAN GREETING PUBLISHERS, INC. CLEVELAND, OHIO

TEN MAIN AREAS OF COST REDUCTION ACTIVITY are concentrated in the production department at American Greeting Publishers, Inc. The reason for concentration of all these activities in one department stems from the belief that coordinated action by one group can produce greater results than individual action by the same number of people acting in separate groups.

The main divisions in the production department that carry on cost reduction functions are: (1) industrial engineering; (2) planning and scheduling; (3) maintenance and engineering; and (4) suggestions. Reference to the organization chart (on following page) will show which groups of this department contribute to cost reduction activities in the various areas.

Three Steps to Cost Reduction

Coordination of cost reduction efforts by this group is provided by a control system set up for the control of cost reduction projects:

Step 1. For any section of the entire organization that either encounters need for assistance in analyzing an existing operation, or desires to set up a new operation, the first step is to outline the idea and submit it on a request for technical service form. As requests are received in the production department, the projects are assigned to the specific divisions of the department that are responsible for cost reduction in the particular areas of work involved. Supervisors of the various divisions are responsible for seeing that projects assigned to their divisions are completed by the "needed" date.

Step 2. Weekly progress reports are submitted by the various division heads to the production manager. They constitute the second step in effective control of cost reduction efforts. These reports show the progress of projects under their jurisdiction. Projects are divided on the report into three sections—those completed within the reported week, those active and currently being worked on, and those that are inactive (i. e., they either have due dates sufficiently far in advance so that no work has to be done, or have been set aside temporarily for more urgent work). Additional copies of these reports are sent to the various operating department superintendents in order that they may be kept abreast of the progress on the projects they have requested.

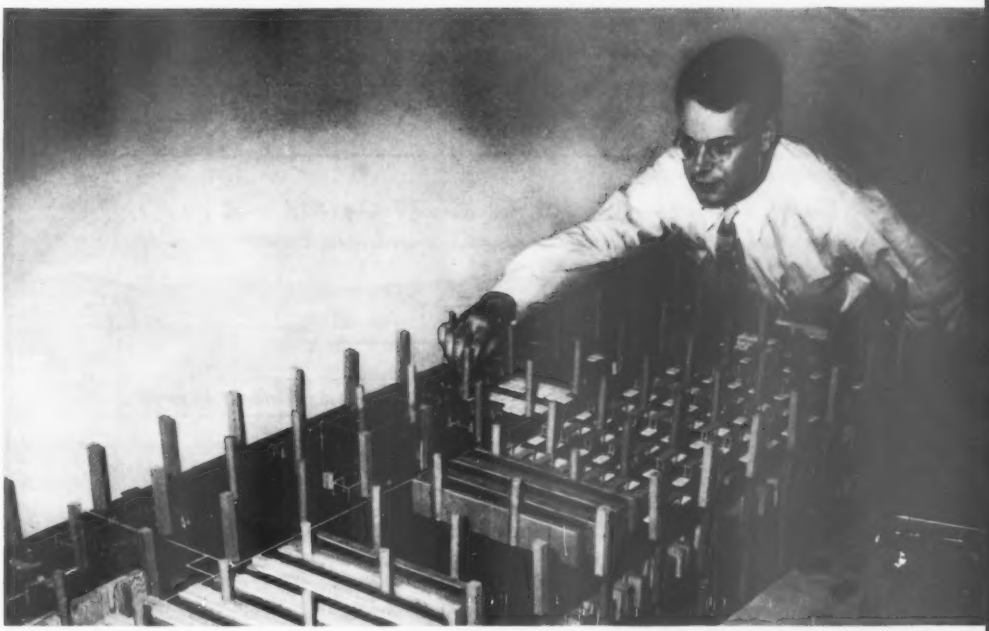
A weekly meeting of the production department results in all projects on the active and inactive list being reviewed with division heads for the purpose of both spurring on cost reduction activities and revising schedules so that projects with higher priority may receive first attention.

Step 3. A methods authorization report is the third step in the systematized set-up for cost reduction. This report outlines the final results of all studies made on a project and reports: (1) equipment to be used; (2) material to be used; (3) layout required; (4) method to be used; (5) estimated production per hour; (6) date operation is to begin; (7) number of people required; and (8) warehousing requirements. The methods authorization report with substantiating data is forwarded to all departments that will be affected by the change. Receipt by operating department superintendents in advance of actual action not only allows them to make certain that the action expected to be taken is thoroughly in line with good practice, but that the dates for action will not interfere with other production operations.

How the System Works

The operation of the control system may be seen by following a project through the three control stages, as illustrated in the display on pages 68-69. In this instance, the request for technical service involved determination of a method and layout for assembly of an assortment of cards.

The request, submitted February 3, was assigned a project number of IE-5 and specified a "needed" date of March 1. The progress report of the indus-



THREE-DIMENSIONAL SCALE MODEL OF AMERICAN GREETING PUBLISHERS' PLANT IS AN AID ON NEARLY ALL PROJECTS

trial engineering department for the week ending February 25 shows that the project is active and is high on the priority list, but is not yet completed. (Later reports of the maintenance and standards departments would indicate progress in installing the new method and layout, and in determining appropriate standards.)

That the initial stage of this particular project was completed on schedule, however, may be seen from the methods authorization (shown in part only), which was issued on March 1.

Results of concentration of all cost reduction activities in one group may be seen from the following activities carried on by the group in the various areas of cost reduction:

1. Materials Handling

A brief picture of former activities on materials handling is in order. Printed card stock in sheets was formerly received on skids and handled from the receiving dock to storage areas by small hand trucks. Movement of skids to the embossing and cutting presses and from there to the sorting areas was of a similar "hand-handled" nature.

Packing of assorted boxes of cards was formerly a completely manual operation. Girls seated at a table passed the assortment box from one to another, inserting a card in the box at each station. From a materials handling standpoint, these operations were admittedly inefficient. The aim of the group in studying this problem was to devise a completely coordinated materials handling system that would eliminate, so far as possible, all manual handling from time of receipt of raw stock to shipment of finished cards.

Palletizing program. Cooperative arrangements have been made with manufacturers supplying envelopes, assortment boxes, and shipping container corrugations, to ship all their material on our standard 36x48-in. pallets.

Printed flat stock is and will continue to be received on skids from the lithographers. As soon as this flat sheet stock is moved to the cutting room and the cards cut from the sheet, cards are separated and stacked on pallets. At the present time, insufficient numbers of pallets are at hand to provide this method of handling for all products. Use of pallets, therefore, is now limited to holiday merchandise. From the point of cutting to final shipment, however, all cards are handled on pallets.

An interesting comparison can be made between the number of skids formerly used and the number of pallets we eventually expect to use. In 1947 we had 10,000 30x48-in. skids. In 1949 we have in use 6600 skids and 3650 of the 36x48-in. pallets. This represents a 2.5 per cent increase in available handling equipment, but has resulted in a 19 per cent total increase of material handled in 1949 over 1947. By 1951 we expect to be operating with a total of only 7700 pallets, at which time our increase in material handled over 1947 is expected to be approximately 25 per cent. In addition, we have found that pallets require less maintenance, are 22 per cent cheaper in initial cost, and generally last longer.

Although the total cost of conversion from skid to pallet operation will be $48,376, the program is expected to pay for itself in less than eight months. Savings are calculated as follows: storage space, $16,000; direct labor, $54,530; skid repair and replacement, $3430.

Text continued on page 87

REQUEST FOR TECHNICAL SERVICE

☐ DEVELOPMENT OF ITEM OR PROCESS ☑ LAYOUT (NEW OR REVISED)	☑ METHOD (NEW OR REVISED)	DATE 2/3/49 NEEDED DATE 3/1/49

DESCRIPTION OR SPECIFICATIONS

Furnish method and layout for assembling 25¢ and 29¢ 1949 Christmas Cellopacks and for the final assortment assembly

REQUESTED BY J. Williams	DEPARTMENT Planning & Scheduling	
PROJECT NO. IE – 5	PROJECT NAME 25¢ & 29¢ Xmas Cellopack – Method & Layout	APPROVAL WM

PROGRESS REPORT—INDUSTRIAL ENGINEERING WEEK ENDING 2/25/49

TO: Production Manager CC: Oper. V.P. Press Dept. Traffic & Stores Plant Prod. Supt. Finishing Dept. Packaging Dept. Order Fill. Dept. Planning & Sched. Dept. Maintenance Dept.

COMPLETED

PROJECT NO.	PROJECT
IE – 37	$1.00 Write-A-Note – Methods & Layout
IE – 38	Cellopack Line – Methods & Workplace Layout
IE – 39	Layout for Hand Gluer – Finishing Dept.

ACTIVE

~~IE – 3~~	1949 Xmas Foil Wrap – Methods & Layout
IE – 5	25¢ & 29¢ 1949 Xmas Cellopack – Methods & Layout
~~IE – 9~~	Move Art Prod. Dept. to 3rd Floor, Plant A – Layout
IE – 11	FMN Box Labeling – Methods
IE – 15	Palletization Program
IE – 18	702 Stores – Methods & Layout
IE – 19	Stripping Die Cut Sheets – Methods & Layout

INACTIVE

		ASSIGNED TO
IE – 7	Tags & Seals Assembly	NB & HB
IE – 8	12/25¢ Cellopack	HB
IE – 10	Floor-in "Wiregar" P	

PROGRESS REPORT—INDUSTRIAL ENGINEERING ACTIVE DETAIL SHEET

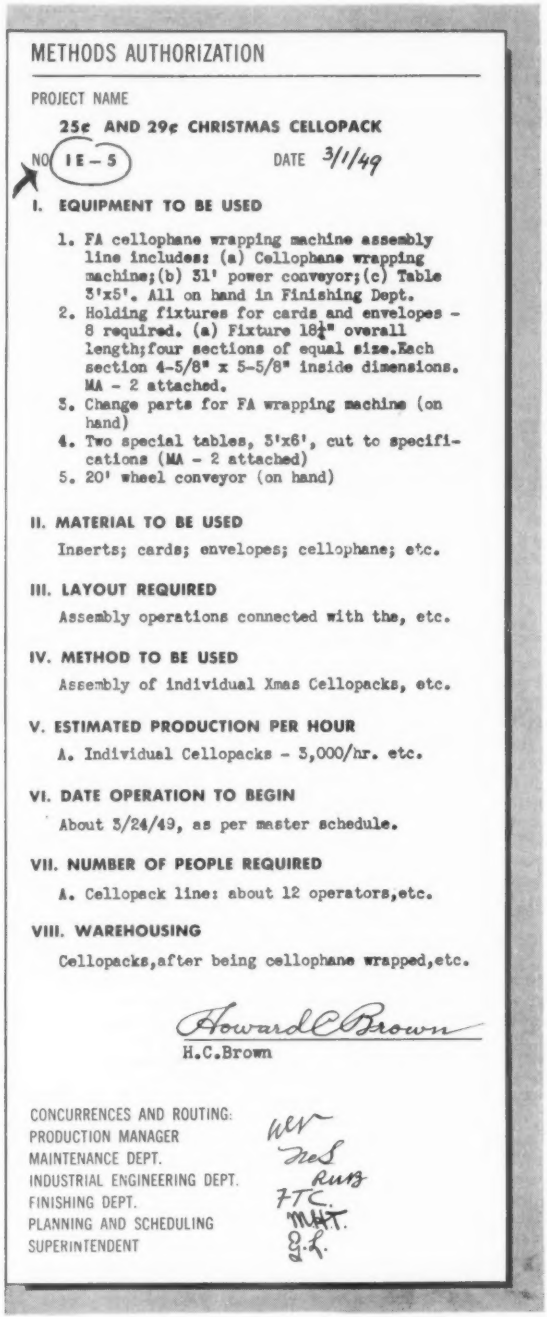
PROJECT NO IE – 5 **25¢ AND 29¢ CHRISTMAS CELLOPACK**

SCOPE AND STATUS:

DESIGN – Complete	WORKPLACE LAYOUT – Determined
EQUIPMENT – Determined	PROD. METHOD – Determined
MATERIAL – Determined	PERSONNEL – Determined
PLANT LAYOUT – Determined	WAREHOUSING – Complete

FORECAST: 3/4/49 COST: Approximately $100.00 ASSIGNED TO: H.C.Brown

THREE-STEP PROCEDURE on cost reduction project is initialed by request for technical service. Weekly progress report by industrial engineering shows status of all projects referred to it (other sections issue simi-



METHODS AUTHORIZATION

PROJECT NAME

25¢ AND 29¢ CHRISTMAS CELLOPACK

NO. IE-5 DATE 3/1/49

I. EQUIPMENT TO BE USED

1. FA cellophane wrapping machine assembly line includes: (a) Cellophane wrapping machine; (b) 31' power conveyor; (c) Table 3'x5'. All on hand in Finishing Dept.
2. Holding fixtures for cards and envelopes - 8 required. (a) Fixture 18¼" overall length; four sections of equal size. Each section 4-5/8" x 5-5/8" inside dimensions. MA - 2 attached.
3. Change parts for FA wrapping machine (on hand)
4. Two special tables, 3'x6', cut to specifications (MA - 2 attached)
5. 20' wheel conveyor (on hand)

II. MATERIAL TO BE USED

Inserts; cards; envelopes; cellophane; etc.

III. LAYOUT REQUIRED

Assembly operations connected with the, etc.

IV. METHOD TO BE USED

Assembly of individual Xmas Cellopacks, etc.

V. ESTIMATED PRODUCTION PER HOUR

A. Individual Cellopacks - 3,000/hr. etc.

VI. DATE OPERATION TO BEGIN

About 3/24/49, as per master schedule.

VII. NUMBER OF PEOPLE REQUIRED

A. Cellopack line: about 12 operators, etc.

VIII. WAREHOUSING

Cellopacks, after being cellophane wrapped, etc.

Howard C. Brown
H.C.Brown

CONCURRENCES AND ROUTING:
PRODUCTION MANAGER
MAINTENANCE DEPT.
INDUSTRIAL ENGINEERING DEPT.
FINISHING DEPT.
PLANNING AND SCHEDULING
SUPERINTENDENT

lar reports). Methods authorization, shown only in part, completed the planning on this project

As a part of this palletizing program we have purchased three 2000-lb. electric fork lift trucks and one 6000-lb. gas fork lift truck. These trucks have not only made possible the greater utilization of vertical space by their ability to stack material to the ceiling, but have resulted, in the last year alone, in a reduction of stock handling employees from 71 to 52.

Shipping. This department has been mechanized. Box assortments in shipping cartons come down a roller conveyor from the second floor and drop onto a storage conveyor built along the wall. At this point a single operator loads the pallets, then removes the completed pallet loads by electric fork lift truck to the shipping storage area immediately adjacent. Here pallet loads of cards are stacked for final shipment. Use of roller conveyors between floors has eliminated downward elevator movement of completed goods and has freed elevator time for carrying paper stock and cut cards up to processing departments.

2. Work Simplification

Work simplification operations have been divided into six categories: (1) operation—manufacturing; (2) operation—service (stores); (3) operation—service (order filling); (4) operation—merchandising; (5) development of new lines; and (6) office procedures.

Upon receipt of the request for technical service, the project is reviewed by the production manager and is sent to the industrial engineering manager, who enters it on a weekly report and assigns it to a methods engineer. Each engineer has a backlog of methods studies for which he is responsible and for which a predetermined priority has been established. The engineer responsible for the job makes a complete study of the operation, develops a new procedure, establishes a standard, and submits a final report. An example of such a study has already been described in connection with the request from the sales department for an inexpensive package of cards wrapped in cellophane. It need only be noted that development procedures conform to standard work simplification practice.

3. Plant Layout

Plant layout is a recurrent problem with us because of seasonal variation. We are constantly setting up new lines and dismantling old ones. The problem is aggravated by large-scale additions of presses, box making, wrapping, bagging, and other machines for operations that are being incorporated into our manufacturing. A three-dimensional six-floor layout not only helps us to determine the exact space required for the various operations, but also helps to sell foremen and top management, where necessary, on the efficiency of planned moves.

4. Production Control

At present the production department issues shop orders, keeps a load-ahead board, records order completions, and issues weekly reports to top management. The operating departments make out requests for material for stores and transfer forms for moving material to following operations.

A proposal is currently being studied that combines all issuing functions into one master form which will be issued by the production department. To expedite flow of forms to and from operating

departments, pneumatic tubes will be installed. It is expected that a change to this system will save at least half of the present cost of production control.

5. Inventory Control

A recent study of the existing inventory control procedure has resulted in the installation of a completely new perpetual inventory setup.

Not only has this new control system eliminated the need for year-end physical inventories (its accuracy is 99.65 per cent), but it has also eliminated 60 per cent of the paperwork formerly required and has reduced posting errors from 9.45 to 0.3 per cent.

6. Special Machinery

Considerable savings have resulted from the development of special machinery for the processing and boxing of cards. Machine development is carried on by the department in two directions. Relatively simple machinery, such as packaging and drying equipment, is designed by the development division of the maintenance department in cooperation with the industrial engineering departments. Relatively complex processing machinery is generally subcontracted to outside machinery builders, and the development function is coordinated between the builder and the development division.

Machines that have been developed internally include a glitter flocking machine, which deposits the glitter on a pre-glued surface; a glue dauber; and an infra-red unit for drying the glue prior to packaging cards. Machines developed in cooperation with machinery builders include a card counter for making up card assortments and a glue applicator for complex gluing operations.

7. Manufacture of Purchased Products or Services

Considerable work has been done in the area of eliminating purchased products or services. We formerly performed only the operations of final decorating and boxing of cards. In the last three years as a result of studies of possible cost reductions in such operations, the production operations of embossing, die-cutting, and imprinting have been added to our regular processing operations. Such operations are not incorporated into our process until thorough methods studies have been made to determine the effect that these operations will have on our established manufacturing organization.

For example, a box-making machine has been purchased which is expected not only to reduce the cost of our assortment boxes by 50 per cent, but also to give us a more rigid, better-looking box which will provide additional protection to the product. In addition, boxes may be carried in blank and made up as required, thus considerably reducing the amount of storage area required.

8. Standards Development

A recent recommendation to management was a change from the development of standards by time study methods to development by methods time measurement. (See FACTORY, February, 1948).

A training program has just been completed for production and industrial engineering personnel, and we are now in the process of revising all standards using this new technique. At present we have reduced the cost of methods standards development by only 40 per cent as we are checking all base standards against time studies to make certain of our accuracy in the use of this new technique. Eventually we expect to eliminate all time study, and we estimate the cost of establishing standards will then have been reduced by 80 per cent.

9. Product Design

An interesting as well as cost-saving aspect of our industrial engineering control is that of approval of final design of cards.

For example, a card submitted to our estimating engineer for production approval contained so many irregular die cuts in the opened-out or flat condition that each card would have had to be hand folded. By recommending to the art department that the card be made up in exactly the same design but without some of the die cuts, the folding operation was reduced from a hand job requiring 3 hours per 1000, to a machine job requiring 0.2 hours per 1000, with a consequent reduction in cost.

Particularly in the case of novelty items there are many ways available to attach decorations to the cards, some more costly than other. It is the responsibility of the estimator to check each card for all of these production characteristics and to return the card to the art department with his recommended changes, which are aimed to cut production costs, but not interfere with the artistic or sale value of the card.

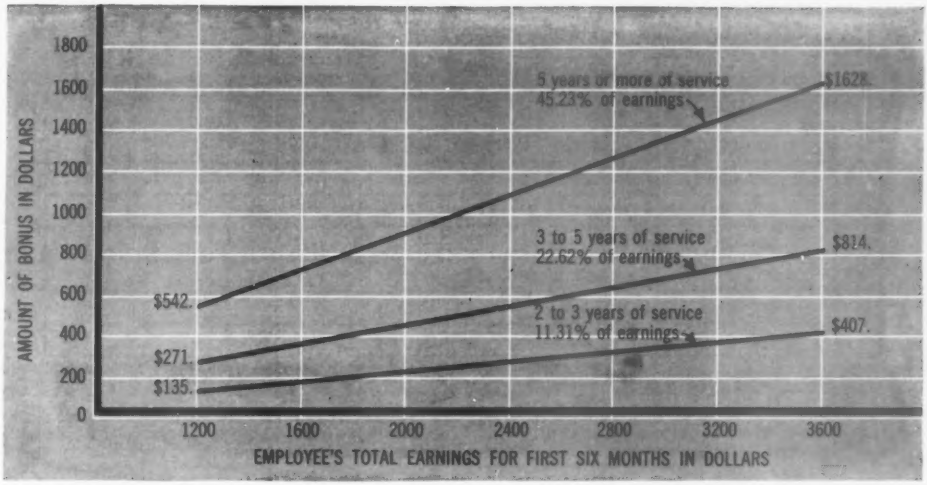
10. Suggestion System

Not the least of the cost reduction activities is the coordination of a suggestion system. Any suggestion requiring time study is referred to the industrial engineering department for analysis, and its findings are reported to the suggestion system supervisor.

Any employee may submit suggestions. However, employees in the administrative, executive, and professional classifications are not eligible to submit suggestions involving their own departments or assignments. Such employees do receive recognition on their merit record for other suggestions. All suggestions are investigated personally by the two suggestion investigators, who devote their full time to carrying out this program.

When a suggestion is received, it is immediately acknowledged and carefully recorded. It is then routed to interested personnel, and those to be seen regarding the suggestions are brought into the picture personally by the investigators. After all comments are secured, they are summarized and the suggestion is placed before the operating committee member in charge of the department affected by the suggestion. He either accepts or rejects the suggestion after the findings are outlined to him, and rules on the amount of the award (based on a set suggestion-award schedule). If rejected, a full explanation is given the suggestor, who has a right of appeal if he feels the suggestion was not given proper consideration. If a rejected suggestion is adopted within one and a half years after the suggestion was submitted, the suggestor is entitled to an award.

Each week a brief outline of suggestions received during the week is sent to the various department heads and to those to be seen in the departments listed. A comparison of suggestion statistics for the first two months of 1949 with the first two months of 1948 shows increases of 31 per cent in total number made and 43 per cent in number accepted.



WORKERS GET 10 PER CENT OF NET PROFITS. GRAPH SHOWS HOW BONUS WAS PRORATED FOR FIRST SIX MONTHS

Profit Bonus Depends on Length of Service

CONVINCED OF THE SOUNDNESS of employee participation in company profits, Panther Oil & Grease Company, Fort Worth, Texas, is well satisfied with the results of its new profit-sharing bonus plan. In the first six months of operation, say company executives, increased output resulting from the plan has slightly more than paid for the sizable bonuses that have been given out. More enthusiasm in the plant and offices, less absenteeism, and a general effort by employees to develop cost-cutting suggestions account for higher production and profits.

The efforts of the sales force, of course, are also a factor. During the first six months of the plan, gross sales increased $107,000 over the corresponding previous period. Officials also attribute much of this gain to the effects of the bonus plan.

Here is how the plan works:

Ten per cent of net profits are earmarked as a distribution bonus to be divided among eligible employees semi-annually. At the close of each six-month period a firm of accountants determines the gross amount of the fund and the sums to be paid to individual employees.

Eligibility is based on length of service with the company. Employees with five or more years of service receive a bonus based on their full gross income for the six-month period. Those with three to five years of service are paid on the basis of half their gross income, and those with two to three years of service on the basis of one quarter of their gross income. Employees with less than two years of service are not eligible.

Computing the Bonus

The amount of the bonus is computed as follows:

1. The appropriate gross income figures for all eligible employees are added up to give the total "participating earnings" of the group.

2. The ten per cent set aside from net profit during the six-month period is figured as a percentage of total participating earnings.

3. This figure is the "bonus percentage." To determine dollar amount of bonus, the appropriate gross income figures are multiplied by the bonus percentage.

For example: The bonus percentage for the first six months was 45.23 per cent. A five-year employee whose gross income during the period was $1800 received a bonus of 45.23 per cent on the full amount of his earnings, or $814.14. The bonus for a three- to five-year employee earning the same income was based on *half* his earnings and was therefore $407.07. A two- to three-year employee received a bonus on one fourth of $1800, or $203.54.

On the basis of operations during a major part of the second six months it is estimated that profits realized will increase enough so the bonus will be approximately 65 per cent. This will make the average for the first full year of the plan's operation about 55 per cent.

Payment of bonus is made by check approximately 90 days after the close of each period. Feeling that the time interval is too long, the company may later go to a system of monthly payments.

It is evident that the size of the bonus paid to individual participants will begin to shrink if the number of eligible employees should materially increase. Since the firm is growing, careful study is being given to this problem. Particular attention is being given to the pros and cons of increasing to more than ten per cent the share of net profit set aside for distribution, to avoid bonus shrinkages that may occur while net profit may be on the up-trend.

1

No.	Code	Equipment Nomenclature	Remarks	Unit Serial No.	Accessory	Equipment Reg. No.
1	9-007-01	Electric Truck	Hangar	01		
2	9-007-02	Electric Lift Truck	Engine Shop	02		
3	9-007-03	Fork Lift	Stores	03		
4	9-007-04	Fork Lift	"CRD-Flush.	04		
5	9-007-05	" "	" " "	05		
6	9-007-06	Electric Lift Truck	Hangar	06		
7	9-007-07	Fork Lift	Stores	07		
8	9-008-01	Steam Generator	Hangar	01		

EQUIPMENT ROSTER lists items in numerical order by code number. Also shown is place of assignment. Each sheet holds 27 items, and new rosters are made up when there is a change in equipment on hand. Roster is filed in loose-leaf binder on the left side. Opposite the roster, on the right side, is the . . .

3 GROUND EQUIPMENT SERVICE & INSPECTION RECORD

Name	Mfr. Name	Mfr. or Dealer Address	Code No.
Lift Truck Electric	Ser. No. 46120		9-007-02

PAA No.	Engine No.	Make	Size of Bore	Stroke
A 14697				

Model	No. of Cyls.	No. of Wheels or Casters	Size of Tires or Casters	Tilting Motor
K41-6M				P/N K9549 FY48/600 S/N 430845

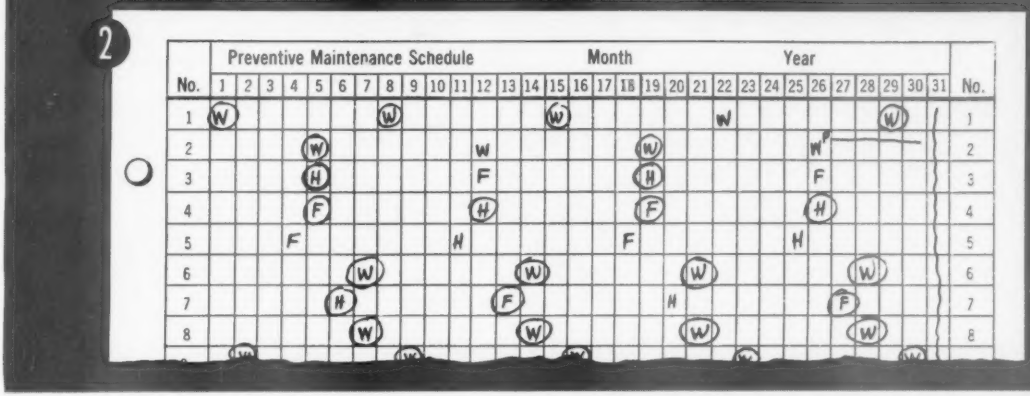
Driving Motor	Hoisting Motor	Size of Compressor
A/N K9093 BY30/36A S/N 808051	P/N K90200 BY30/36B S/N 622613	

Date Received — Assigned to

1	Front Wheels	7	Universal	13	Generator	19	Fuel Pump	25	Clutch	31	Motor
2	Real Wheels	8	Transmission	14	Starter	20	Fuel Lines	26	Radiator	32	Tires
3	Brakes	9	Differential	15	Lights and Wiring	21	Cyl. and Piston	27	Water Pump	33	Belts
4	Master Cyl.	10	Axle	16	Distributor	22	Cyl. Head	28	Hydraulic Pump	34	Controls
5	Wheel Cyl.	11	Spring	17	Plugs	23	Valves	29	Hydraulic Line	35	Semi-Service
6	Steering	12	Battery	18	Carburetor	24	Fly Wheel	30	Compressor	36	Body

DATE	UNIT NO.	ACTION	MILEAGE OR HOURS	INITIAL	DATE	UNIT NO.	ACTION	MILEAGE OR HOURS	INITIAL
48 8-12	1	CHECK R.F. WHEEL + BEARINGS CLEAN BATTERY COMPART.		Diesel	48 10-11	12	SERVICE BATTERIES CHARGE		Dunn
48 8-16	(10)	CHANGE AXLE DRIVE - GEAR PINION		Beck Spanter					
48 8-27	12	CHANGE PLUG, PAINT BATT. BOX. REPAIR CABLES. CHARGE		Sanford					
48 9-4	12	CHECK + CHARGE		Dunn					
48 9-19	12	FILL + CHARGE		"					
48 9-26		TOW OUT OF DITCH - CHARGE		"					
48 10-5	12	TOW IN - SERVICE BATT. CHARGE		Smith					

SERVICE AND INSPECTION RECORD. This form holds a complete record of the equipment's service history. It is made up when equipment is purchased, and entries are posted from service assignment cards. Unit number (circled) is used for costing by accounting department. Form also shows who did repair job



MAINTENANCE SCHEDULE. Prepared monthly, it carries service data for equipment in same line as roster. W indicates weekly service, M, monthly. P means deadlined for parts, H signals a 100-hr. service, and F, a 50-hr. service. Circle shows the job has been completed. Equipment status can be checked quickly

Equipment Upkeep Plan Cuts Replacement Cost 50 Per Cent

LEE L. TYLER • MANAGER, AUTOMOTIVE SHOP
PAN AMERICAN WORLD AIRWAYS, NEW YORK

WE MAINTAIN everything from a wheelbarrow to a 2000-ampere mobile generator at the Atlantic Division of Pan American World Airways, LaGuardia Airport. More than 265 assorted pieces of ground equipment assigned to several departments are scheduled for inspection and preventive maintenance.

Without some paperwork, we'd be lost. With too much, we'd be swamped. The setup we've adopted has kept us astride of the problem of keeping more than a million dollars' worth of vital equipment ready for instant service. Moreover, we've reduced equipment replacement costs by 50 per cent. We know *who* did a job, and *how* and *when* it was done.

To keep track of it all, a code number was assigned each piece of equipment. This three-part number is functional. For example, the number 9-007-03 designates a fork truck. The first digit indicates departmental location of the truck; the next three indicate kind or type of equipment; the last two, the equipment number. In this case, 03 means it is the third item of Type 007. This code number is used several ways. A metal tag is embossed with it and fastened to the equipment. All paperwork mentioning the equipment carries the number for identification, and, finally, the cost accounting department uses the number to assign costs. On time cards, a suffix is added to the code number. To indicate repair, zero is used; 1 means weekly service; 2, semi-monthly service; 3, annual service.

As soon as a new piece of equipment is obtained, it is listed on an equipment roster (Figure 1). This roster is prepared by a clerk in the maintenance department.

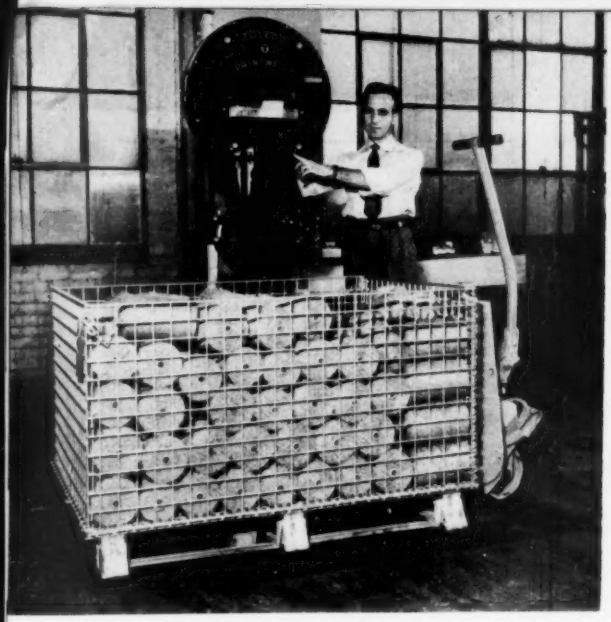
A maintenance schedule (Figure 2) is then set up by the clerk for the month, based on information supplied by the maintenance chief.

The maintenance chief has determined the time required for normal service of each piece of equipment and knows the number of man-hours available per day. He can, therefore, set up a master schedule on that basis.

As work is assigned from the schedule and completed, the call letter indicating the work to be done is circled. Letters not circled show that service was missed for one reason or another, but in each case equipment rarely fails to get serviced or inspected three scheduled times out of every four. The maintenance chief can look over the schedule to ascertain what items are deadlined for parts (P, Figure 2), which items require weekly servicing (W) or monthly servicing (M). On the schedule, F signifies 50-hour service, and H means 100-hour service for those units equipped with hour meters.

Forms (Figures 1 and 2) are kept by the maintenance chief in a loose-leaf binder so they actually appear as shown above.

Another record maintained is the ground equipment service and inspection record (Figure 3). This constitutes a complete history of repairs and services required by the unit. Both sides are used when necessary. The card contains valuable information and is used to determine whether or not a piece of equipment should be sold or whether the same item would be a good buy again.



WEIGHING is simplified by setting tare to account for weight of pallet truck and empty container, which is uniform

STORAGE uses vertical space and requires three men instead of the previous twelve

Company Gains Five Ways With

1 **WEIGHING** operations in the winding room require one man instead of four.

2 **STORAGE** area handling requires only three people instead of twelve.

3 **HANDLING** operations are cleaner, and there is less chance of confusing the many colors, lots, and types of yarn.

4 **TAKING** a complete physical inventory of some 400,000 pounds of yarn requires only six people on a Saturday and Sunday; previously, this took fifteen people a solid week during a shutdown.

5 **CHECKING** of the perpetual inventory to be sure all the yarn required for a particular run is on hand can be done in a few hours at most, sometimes in a matter of minutes.

JAMES F. McLAUGHLIN • ASSISTANT TO THE VICE PRESIDENT, BEATTIE MANUFACTURING COMPANY, LITTLE FALLS, N. J.

SUBSTITUTION of collapsible wire mesh basket pallets for the traditional canvas baskets in our yarn handling operation has brought Beattie the five distinct advantages name above.

In general, these advantages are the result of two factors: The containers we are now using have a capacity of about 530 pounds, while the canvas baskets have a capacity of roughly 50 pounds; and the new containers can be handled by fork truck or hand pallet truck, while baskets were handled manually.

THE OLD WAY • With the baskets, a spool of yarn was removed from the winding machine and placed in a basket, which then had to be carried or dragged across the floor to the scale. After the baskets had been weighed, they were loaded on a dolly and pushed to a chain conveyor which carried them down to a loading platform where they were stacked manually on a truck. They were then trucked to the unloading platform of the axminster mill, where they were placed on large platform trucks to be carried to the yarn storage room. Once in the storage area, the baskets had to be unloaded by hand into fixed, wooden bins.

As yarn was required, it had to be removed from the bins, carried

HANDLING is cleaner and there is less chance of confusing colors, types, and lots because the baskets are of open mesh construction which permits all foreign matter and discarded tags to fall through to the floor

Collapsible Basket Pallets

or dragged to the scales, weighed, and then placed in the racks from which the setting machine operators took spools as needed.

To take a physical inventory, all yarn had to be removed from the bins, weighed, and returned to bins. Because there was no way of short-cutting this process for checks on particular items, the perpetual inventory had to be relied on except in extreme cases.

Lint, dirt, and obsolete identification tags accumulated in the bottom of the baskets. This made later cleaning operations more difficult—and yarn sometimes found its way into the wrong bin.

THE NEW WAY • With the wire-mesh basket pallets, the operator at the winding machine stacks the spools in the container as before. But now the handler uses a pallet truck to pick up the full container, with ten times as many spools as before, and moves directly onto the scale. By setting the tare to take into account the uniform weight of our pallet trucks, even this simple unloading operation is avoided.

From weighing, the container is trucked a few feet to the end of the building where a power hoist with a specially designed sling lowers it to a standard road-type platform truck below. This truck moves twelve containers at a time out into the street and around the block to the storage building. There, pallet trucks pick up the containers and deliver them to the storage area. A high-lift fork truck, capable of maneuvering the 40x48-in. containers in an 8-ft. aisle, stacks them five high. Despite the wider aisles, utilization of vertical space has materially reduced the number of square feet required for storage.

As yarn is required, the fork truck can deliver containers directly to the scales for weighing and loading to the operators' racks.

When we wish to take physical inventory, we have only to weigh the partially loaded containers. The mesh construction of the containers makes it possible to see which ones are fully loaded, and certainly there can be no question of the accuracy of the perpetual inventory on those containers.

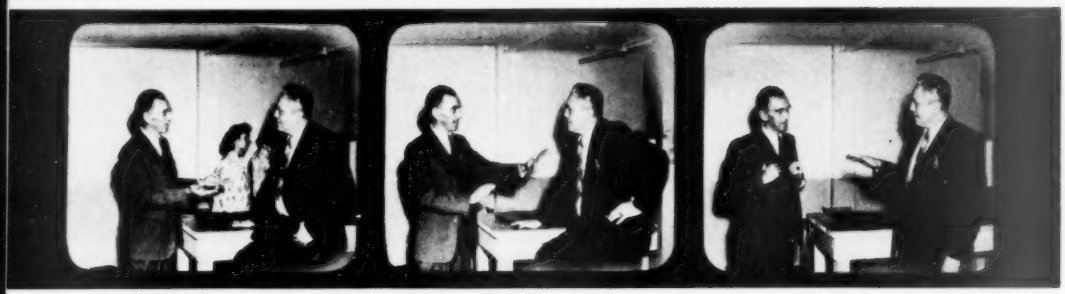
Production of axminster carpeting, particularly, once presented a problem that is now more readily solved. For example: Certain specified quantities of 20 different colored yarns are required to set up the design on the carpet pattern; it is vitally important that all colors be available as needed. If shortages occur, machines are held up while the missing colors are dyed. If the shortages appear in a widely used ground shade, it is almost impossible to get a satisfactory color match, and the resulting carpet would be made a "second." No longer must we rely completely on the perpetual inventory cards. Chances are that most or all of the yarns exist in sufficient quantity, so that a visual check of the full container will guarantee clear sailing. In a few cases, some containers may have to be removed from the stack and weighed, but that's a small price to pay for the trouble it avoids.

As for dirt and old tags causing difficulties—it just can't happen. The mesh construction permits all foreign matter to fall right through to the floor, where it will be swept out of the way of our production operations.

Announcer: This case of Joe and Bob occurred in an Armstrong Cork Company plant . . .

. . . In presenting it, different names, different persons, and different places are used but . . .

. . . the facts presented are true. Now let's meet Joe, supervisor of department B. Joe is sore . . . ——▶



Joe: Say, Bob, where is order 642 that you should have had in my department two hours ago?

Bob: We've been tied up with two specials and we haven't been able to get the stuff out for you.

Joe: Always an alibi! It's your fault, and believe me the boss will be told where the trouble lies.

TITLES AND SUBJECTS OF ARMSTRONG SOUND SLIDE FILMS

No.	Title	Sex	Subject	Supervisor and Employee	Supervisor and Superior	Supervisor and Union	Supervisor and Equiv. Supervisor	Supervisor and Staff	Employee and Employee
1	"Mary Benson"	F	Insubordination	✓		✓			
2	"A Difference of Opinion"	M	Dealing With Union		✓	✓	✓		
3	"Independent Sadie"	F	Insubordination	✓	✓				
4	"Tom, Dick and Harry"	M	Reducing Crew Size	✓		✓		✓	
5	"Paul Steele"	M	Insubordination	✓		✓			
6	"Joe and Bob"	M	Poor Cooperation				✓	✓	
7	"Alice, Jane and Agnes"	F	Change in Operation	✓				✓	
8	"Al Miller"	M	Horseplay	✓					✓
9	"Harry Carey"	M	Working Relationships		✓				
10	"George Gray"	M	Insubordination	✓	✓				
11	"Lefty Laws"	M	Trial Employment	✓	✓	✓			
12	"Sara Blake"	F	Tardiness	✓		✓			
13	"Emma Trimble"	F	Training for Flexibility	✓					
14	"John Beaver"	M	Tardiness		✓				
15	"Jerry Cooper"	M	A.W.O.L.	✓					
16	"Frances Moore"	F	Balancing Work Load	✓			✓		✓
17	"Mike and Bill"	M	Friction Employees	✓					✓
18	"The Three Calendeers"	M	Low Production	✓					
19	"Jim Halsey"	M	Safety		✓		✓		
20	"Jake Diller"	M	Physical Handicap	✓					
21	"Tessie Teller"	F	Slow Down	✓		✓			
22	"Violet Smith"	F	Job Pride	✓					✓
23	"Dewey Jones"	M	Assign Responsibilities	✓					
24	"Otto Bragg"	M	Talks Too Much	✓					
25	"Jack, Glenn and Ed"	M	Department Flexibility	✓				✓	

...Two machines have been down for nearly two hours because order 642 was not delivered on time...

...Joe decides to find the reason for the delay. He enters department A, which was to send the order...

...and finds Bob, the foreman, engaged in talking to two employees. Without waiting...

Announcer: With that, Joe turns his back on Bob, and stalks off to his own department...

...Put yourself in Bob's place. Think it over carefully and then you decide. If you were Bob...

...What would you do?
(Some frames have been omitted, some dialogue is paraphrased.—Ed.)

Provocative Sound-Slide Films Stimulate Supervisors' Thinking

Don't *tell* supervisors the answers to their human relations problems; *ask* them

NEITHER SOUND SLIDE FILMS nor role playing are new or unique as human relations training devices. But Armstrong Cork Company has combined what it believes to be the best features of each and has added an element, to produce a technique which, if not a first is unusual.

The element which has been added ("subtracted" would be a more accurate word) is simply this: No attempt is made to carry an episode through to its conclusion, or to state the principles on which the solution should be based.

In every instance, the slide film story—produced by the Armstrong personnel department and always based on an actual case history from Armstrong files—is brought to the point where the central character (usually a supervisor) must make his key decision. At that point, the story is interrupted, and the next slide to flash on the screen asks the question: "What would *you* do?"

From there on the matter is entirely in the hands of the discussion leader and his group—usually 15 to 20 men. All levels of management, from the vice president in charge of manufacturing to shift foremen, participate in the program.

The films are brief, usually two to five minutes, so a one-hour conference usually allows ample time for discussion. Three prime questions are asked in reference to each situation:

1. What are the important factors in this case?

2. What results do you want to accomplish, and how?

3. How could the situation have been avoided?

These questions are taken up one at a time, and in the discussion of the first two the group is limited to a consideration of the facts as they exist at the end of the film. Nothing can be changed; the situation must be accepted and dealt with as one that has already occurred. Only when it comes to the third question does the group undertake to criticize the manner in which the situation was handled up to the point where the film stopped.

What are the advantages of this approach over the more conventional slide films or straight role play-

ing? Experience with showings of the first twelve films in the series at two-week intervals (thirteen more films are projected) seems to indicate certain conclusions.

Advantages of Films

1. *Uniformity of presentation.* Even the inflections in the voices of the men in a role-playing situation can alter the basic elements in a case. Consequently, where more than one group is studying the same case, the varying actions of the players may destroy the intended comparability. Many times a player becomes self-conscious, excited, or embarrassed, with the result that he introduces an entirely unnatural feeling into the role. And it is not impossible that an occasional frustrated actor will "ham up" a role, and so alter a situation.

All of these variables are removed by using films, and an additional air of authenticity is provided by showing the action in its proper setting—the shop, the foreman's office, the plant gate, or wherever it took place (although the film is never made in the same plant or with the actual personnel involved in the original incident.)

2. *Stimulation of discussion.* Most training films present a solution to the problem illustrated. In some cases, it is a specific solution; more often, it is a statement of the principle or principles on which a specific solution should be based. The result is to discourage discussion, for little if anything has been left unsaid.

Role playing is a better discussion stimulant, but the discussion generally centers around the technique displayed by the supervisor, and on how the situation might have been avoided if it had been handled better.

The Armstrong films encourage criticism of technique displayed, but go still further in promoting discussion by *not* presenting a solution. The group members are thereby challenged with a problem to solve and are at least mildly flattered by being *asked* rather than *told* the solution. Furthermore, the avoidance of any "stock" solution makes the films equally acceptable in all of the company's plants and departments.

3. *Examination of policies and practices.* Because the technique used stimulates considerable discussion in many groups on an identical problem, it is possible to make revealing comparisons at three levels:

(a) Interpretation and application of policies within a single group of comparable supervisors. Since all of these men operate under the same general policies, little or no difference should be evident in the interpretation of these policies—although discussions have sometimes disclosed both reasonable and unreasonable disagreement with established policies. The nature of the discussion frequently makes it possible to clear up the misunderstandings that most often cause such disagreements, without what might seem to be an "intrusion" by the plant manager or the personnel department. When disagreements are more basic, obviously the matter must be examined in detail by the policy-makers involved.

(b) Interpretation and application of policies by different groups of supervisors within the same plant. Differences other than the type disclosed within a single group are most likely to show up when analyzing the discussions of groups of supervisors at various levels. Office and shop supervisors are likely to differ, too. The discussions, when examined on a plant-wide basis, may also disclose the need for establishing procedures where none now exist.

(c) Uniformity of policies and interpretation of uniform policies in the different plants. Over-all policies affecting human relations in supervision are established by Armstrong on a company-wide basis, but with eighteen plants, producing a wide diversity of products and pretty well scattered across the country, a certain amount of flexibility of application is inevitable and probably desirable. However, too great a variation in policy application can lead to trouble. By being forewarned through these analyses, top management can keep an eye on the situation, and can take action immediately if a more thorough investigation establishes a need for it.

Data Compiled Automatically

The information required for these analyses is compiled automatically in the course of the discussions. Each of the three key discussion questions is printed at the top of an easel-size sheet of paper. As group members suggest the factors they believe are the important ones in the case, the leader writes them down. A similar procedure is followed in connection with the questions of the results to be achieved and the manner in which the situation might have been avoided. A simple summary of the group conclusions placed on the easel sheets during the discussion provides the information for analysis at the plant level; copies are forwarded to the general personnel office at Lancaster.

It is important to note that anonymity is observed at all times, as far as the permanent record is concerned. A man may both criticize and be criticized without being "on the record." The result is more uninhibited discussion that would otherwise be possible.

For the most part, discussions of the films shown have been spirited and hard-hitting. Many times the discussions have carried over from the conference room into the plant and have lasted for several days; in at least one instance, a case was being argued several weeks later.

However, provision has been made for the possibility that the group might not react spontaneously to a given film. The leader's guide to the series contains a list of stimulating, specific questions that may be interjected whenever discussion lags. It has seldom been necessary to use them.

Leaders' Guide Provided

The leaders' guide also contains introductory material on the series and for each film, a check list on conference leadership, fairly extensive instructions for exhibiting sound slide films, and the complete script for each film.

Personnel men at Armstrong emphasize that these are not training films in the normal sense of the word. While they have a definite value for "new" supervisors, they are designed primarily as refreshers and stimulants for men already well grounded in the principles of sound human relations. Nor are the films intended to stand alone and constitute a supervisory program in themselves. They are an additional, and very valuable, element which has been integrated in an already well-rounded human relations program.

Subject matter of the films produced to date and a few of those projected in the "Case Series of Human Relations in Supervision" is indicated in the accompanying table.

CONTROLLING BREAKEVEN POINTS

FRED V. GARDNER • FRED V. GARDNER & ASSOCIATES
MILWAUKEE

TODAY'S profits are in double jeopardy—from buyer resistance and from high breakeven points. Analyzing breakeven points shows management the best ways to reduce costs to meet buyer resistance, and gives clear forewarning of impending trouble from an unfavorable volume-profit relationship.

Through detailed discussion and statistically documented case studies, this article explains for companies both large and small:

I · How Profits Influence Cost Control 98
II · Variable and Fixed Costs 98
III · Factors Affecting Breakeven Points 100
IV · Maintaining Return on Investment 107

FACTORY MANAGEMENT AND MAINTENANCE • Plant Operation Library No. 122 • July, 1949
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I • How Profits Influence Cost Control

In the series of annual reports that have been headlining the newspapers and business publications, statement after statement shows that in 1948 practically every leading company returned the greatest dollar profits it had ever experienced. Many companies have done so well that it is downright hard even to talk to their executives about the problems of cost reduction. They have been lulled to sleep by these fine results. In many cases, however, this apparently good profit performance is due to the fact that volume is three or four times higher than it was prior to 1941. Actually, most companies are picking up only half as much per unit of product.

A combination of two factors—the fact that profit margin per unit is less, and the fact that more and more companies are beginning to show less profit than the year before, even with higher sales levels—is an indication that the problem of cost control is a pressing one that must be met in the near future.

A lesson can be learned from the 1929 period. An examination of the leading companies in our industrial enterprise indicates that the period of readjustment between 1929 and 1932 was accompanied by a definite lag in cost control—i.e., most companies were unable to reduce expenses in a ratio necessary to maintain fair profits on the volume, as volume declined. This resulted in profits disappearing much sooner than they anticipated.

The difference between the costs of operation going down from 1929 to 1932 and going up from 1933 to 1937 was roughly 25 per cent higher costs because of lags in cost control in the down period. This was primarily due to management's inability to keep abreast of rapidly moving adverse conditions which created these lags and were not recognized soon enough.

Breakeven points are tools which management can rely upon in meeting these problems. Many of the better-managed companies are on the road to continued good profits, but others face dangerous cost-reduction problems if they are to operate profitably.

Profits are the measure of efficiency in our economic order. They are the basis from which we obtain the wherewithal to reproduce ideas, equipment, machinery—the basis that provides the working capital necessary to carry out daily activities and the additional compensation to stimulate individuals into better know-how. In addition, profits provide a reasonable return for those who have taken the business risk. Without the profit system in some form we should be unable to carry out our present economic way of life.

Management is the custodian of property. Through the process of turning over the capital available and expending it for materials, machinery, and methods, it is basically the custodian of our entire profit endeavor. In this attempt to measure and express itself in values, management has been required to rely on accounting.

Primarily intended for the protection of those who are or who can be only casually interested in the enterprise, accounting is a formal, exacting accessory-after-the-fact science. The main objective is to know that the facts presented are consistent with the predetermined rules and are basically comparable, as well as understandable to the casual reader. Facts of this kind, however, are not satisfactory for the management that must create profits.

How are profits created? Simply stated, of course, they develop from "sales minus costs." But there is more to the problem than that.

Profits are not, as they appear to be, static ratios of 10, 15, or 20 cents per dollar of sales. Profits depend upon three independent, unrelated conditions, all of which call for entirely different techniques in the process of day-by-day management and major variations in the techniques of long-term management. These conditions are:

1. **Performance of the management itself**—the aptitudes necessary in order to get the ultimate out of items 2 and 3.

2. **Mix of the product**—or the relationship of the various factors in the revenue-producing structure to one another.

3. **Volume**—or the amount of activity of an enterprise during a given period of time, or for a future period of time, in relation to the total amount of capacity that is available.

It is fruitless to attempt to determine profits, to understand or interpret or use profits, unless in the profit calculation and interpretation these factors can be clearly segregated. *Static ratios do not accomplish this segregation.*

Volume distortion between periods being compared has left much unexplained in the question of why profits vary. If an enterprise made 10 per cent on its first dollar of output and 10 per cent on its last dollar of output, and if management efficiency were constantly perfect; if, further, there were no conflicts between styles, shapes, lines, and kinds of production within the enterprise—then and only then would the rule-of-thumb ratio suffice. But these problems do exist, and the managerial task is to meet their challenge and control them. The casual static ratio is not enough if we want specific answers to our analyses of yesterday's and today's work, and of tomorrow's hopes.

II • Variable and Fixed Costs

The rule-of-thumb ratios have been supplanted in modern management controls by the segregation of the elements of cost into *time* and *volume* factors. In an endeavor to spread this principle there has been great progress in management in the last fifteen years. Today the words "breakeven point," which summarize this type of analysis, are becoming more commonly used in industry. But even today their use is somewhat hazy, and they are not as definitely, efficiently, or forcefully used as they might be. There are still too many executives who visualize their breakeven point as X dollars of sales because they lost money below that point of activity or made money above that point. But some managements actually talk "breakeven" in the same vein as they talk about their golf game on the 19th hole.

1 Profits of United States Steel Corporation, 1929—1938

Year	Sales*	Profit Before Taxes*	% Profit to Sales
1929	$960.5	$122.5	12.8%
1932	287.7	71.2 deficit	24.8 deficit
1935	539.4	2.0	0.4
1938	632.5	7.7 deficit	1.2 deficit

*in millions of dollars

2 Breakeven Point Changes of United States Steel Corporation, 1938—1948

	1938	1948
Standby per year	$182.1 million	$260.0 million
Variable per weighted ton	$55.73	$79.25
Breakeven tons per year	8,303,700 tons	10,950,000 tons
Selling price per ton	$77.66	$103.00
Total dollar value of breakeven	$645 million	$1,130 million

To say, for instance, that "my car costs me only 5 cents a mile to operate," is only a half-truth. What are the costs of operating an automobile? Those we know best are the costs of gasoline, oil, tires, general repairs, batteries, all of which are *volume-of-use* costs, in that they have a more or less constant relationship to the measure of use—mileage. We might work out each item in the same way, but for simplicity, let us assume that the total cost for these volume items is 2 cents per mile. Then there are such expenses as license plates, insurance, garage, and taxes that have no definite relationship to mileage. These latter items are *time* costs, which do not vary with mileage. Let us assume that the time costs as we decide them total $30 per month—depreciation, $18; insurance and taxes, $7; rent, $5.

This brings us to a working formula for operating costs:

$$\frac{(\text{miles per month} \times \$0.02)}{\text{miles per month}} + \$30 = \text{cost per mile.}$$

Of course, one cannot expect the average driver to answer with a formula of this type in place of "five cents per mile," even if the formula is a simple one. If the formula is applied to volume (miles), however, one should get a complete picture of operating costs which can be remembered and used by the owner in checking his costs.

The car case is a little unusual because it does not deal with the profit motive directly, unless you are in the business of selling the services of your car. But this case can be carried on to any industrial enterprise; it can be applied, for instance, to the steel industry.

In 1938, appearing before the Temporary National Economic Committee, executives of the United States Steel Corporation endeavored to explain the wide variations in the percentage of profits to sales. See Table 1.

They showed that it cost them $182,000,000 per year to open the plant and keep it as a going concern, regardless of whether they produced 1 ton of steel or 10,000,000 tons. In other words, standby costs (related to time and keyed to the organization structure necessary to operate the company and do the essential things to conduct the business) were $182,000,000 a year. In addition, variable cost amounted to $55.73 per weighted ton of steel produced. Here were costs expressed without distortion by volume factors. But the presentation didn't stop there. Using these factors, the corporation put substance into its breakeven point. Since average selling price was $77.66 per ton, it was picking up $21.93 per ton shipped. To meet standby expenses, therefore, it was necessary to bill and ship 8,303,700 tons of steel ($182,000,000 ÷ $21.93). The indication was, then, that the corporation didn't make 10 per cent or 25 per cent or minus 5 per cent. It showed that it needed 8,303,700 tons to break even, and above that point it accrued $21.93 in profits per weighted ton of shipments.

With these factors uncovered, the United States Steel Corporation was able not only to determine its breakeven point, but also to answer the basic problems of profits:

1. *Performance*—long-term control over the standby costs of $182,000,000; day-by-day control over the variable expenses of $55.73 per ton.

2. *Mix of product*—since it was aware that the variable costs of $55.73 were *weighted* costs and the sell-

3 Profit Pattern of Six Companies

Company	Post-War Years: Sales Increase 1948 over 1947*	Post-War Years: Profits Before Taxes Increase 1948 over 1947*	Post-War Years: Profits Before Taxes, Pickup per $ Added Sales
Bethlehem Steel	$280.3	$66.3	$0.236
International Harvester	204.2	8.3	0.041
Caterpillar Tractor	28.9	6.4	0.221
Mullins	9.8	2.2	0.224
Monsanto Chemical	18.2	0.9	0.049
U. S. Steel Corp.	358.6	20.3	0.057

*in millions of dollars

ing price of $77.66 was a *weighted* selling price, and that whenever the proportion of sheets, bars, etc., shifted, the weighted costs and selling prices per ton were affected.

3. *Volume*—because through the use of these factors it could intelligently measure the profits it should get or the losses it would suffer at every step of the scale from zero operations to 100 per cent capacity.

Comparing today with 1938, U.S. Steel's breakeven factors are shown in Table 2.

This softening condition prevails in general throughout industry. In the 892 manufacturing companies that reported to the SEC and which are engaged primarily in manufacturing (excluding retailing, financing, public utilities, railroads), breakeven points were at 55 per cent of output in the pre-war years—$25 to $30 billion sales per year. Today it takes 115 per cent of their 1935-39 output to break even, even after this output is adjusted to present selling prices. Many of these companies require two to three times the sales volume to break even that they required in the pre-war years of '36 to '39. And instead of picking up 25 cents per dollar of sales above the breakeven point, as they did in those years, they now recover an average of 17 cents on the dollar, which is substantially lower, and which means that profit potentials are materially reduced.

Today it requires nearly $35 billion of sales to break even, and in order to get the same dollar value of profits as in pre-war years, these companies must sell $15 billion over that breakeven point, or $50 billion. In other words, twice as much sales for the same amount of profit. To get the same *percentage* of profit, they must sell $55 billion over the breakeven point. Actually, it now requires $90 billion of sales to get the same profit ratio that was obtained on $25 billion in 1938.

Weakening in Profit Pickup

More intimate study of better-known companies since 1945 provides further evidence of weakening in profit pickup above the breakeven point. Last year *Business Week* presented the comparative sales and profits results of 50 well-known companies. In 1948 these companies increased their volume over 1947 from $10.7 billion to $12.6 billion, and their profit pickup was 15 and a fraction cents per dollar for the additional volume. A study of the details shows that this pickup has varied considerably. For example, in Table 3, six of the 50 companies show profit pickups from as low as 7 cents per dollar of net sales to a high of over 30 cents per dollar of net sales above the breakeven point.

III • Factors Affecting Breakeven Points

Let us apply the fundamental segregations of profits to the Wisconsin Manufacturing Company, a fictitious name assigned to a prosperous manufacturing concern producing three distinct lines of products and having normal profit margin as recorded on the profit-and-loss statement. This company offers a good application of the many items affecting breakeven points. Assuming that we know our own individual

4 Profitgraph Factors by Lines

Projected sales
% of sales to total
Direct labor
Direct material
Factory burden
Total manufacturing cost
Selling expenses
Administrative expenses
Total all costs
Profit pickup above breakeven
Breakeven point per year
% breakeven to projected sales

company breakeven point, the problem becomes one of analysis, and the answers must state graphically a set of facts by which management can plot a future course of action. The question then resolves itself into two phases:

1. *What will happen to sales?*

2. *What will changes in sales volume do to costs, breakeven points, and profits?*

This company now has a normal capacity of approximately $3,000,000 of sales per year. It formerly considered a year good when it produced $1,800,000 of sales on a capacity of approximately $2,000,000. In 1939 it could break even at about 50 per cent of $2,000,000, or at $1,000,000, and above the breakeven point it picked up about 30 cents per dollar of sales. Today this concern has a breakeven point of $2,110,000 (greater than pre-war maximum volume), with a composite variable cost of $77.35 per $100 of sales, resulting in a profit pickup of $22.65 per $100 of sales above the breakeven point. The profit pickup varies materially with lines of product. For instance, product *A* is almost average, with a pickup above the breakeven point of $20.63. Product *B* picks up $35.09 per $100 of sales, and product *C* pickup goes to the low extreme of only $15.33 per $100 of sales.

Under normal conditions, the weighted proportions between these products is 45 per cent for produce *A*, 25 per cent for product *B*, and 30 per cent for product *C*. The schedule herewith gives the breakdown of the factors which together make up the standby and variable costs for each one of these profit lines. The summation and details of this standby and variable segregation, and the resulting breakeven point of this company are shown in the accompanying Table 4.

Changes in standby and variable costs collectively may mean a 90 per cent budget realization. If you have a 95 per cent budget realization, it may mean, on the surface, that your standby cost is not being met by 5 per cent, and your variable cost is not being met by 5 per cent, and the combination of these two has the action of changing the breakeven point and may literally change the pickup. In the light of current trends, a management forecast of operations might take into account possible budget realization of less than 100 per cent. The drop in efficiency, as reflected by increases in standby and variable costs, the resulting effect on the breakeven point, and profit potentials can be quickly measured, and necessary steps taken to offset these effects. Table 5 indicates graphically what might happen to the Wisconsin Manufacturing Company if budget realization were to fall off.

A specific example of the effects of product mix is shown in the Table 6. It is obvious that the standby cost does not change, because it is a fixed amount per year rather than a relationship to volume. This is evident in line 4. However, the variable cost changes from a low of $69.25 (when the product mix is distributed favorably between products *A* and *B*, column B, line 5) to a high of $78.60 (column C, line 5, when the mix is unfavorable and out of proportion as far as product *C* is concerned). The marginal pickup, therefore, changes and has a material effect on the breakeven point. In a favorable condition, as in the first example above, the annual breakeven point is reduced to $1,550,000 (column B, line 7), whereas under the unfavorable condition mentioned above the breakeven point is raised to $2,232,000 per year (column C, line 7). In other words, variations in product mix affect the breakeven point and the profit pickup above the breakeven point because of differences in variable costs within the company's various product lines.

With this information it is easy, through weighting, to determine the amount of profit gained or lost in any given period because of the mix of product. A further study of this schedule, which is only possible by the availability of standby and variable factors by product lines, indicates the tremendous possibilities management has in the analysis of questions concerning sales volumes, marginal sales, changes in product

PRODUCT A		PRODUCT B		PRODUCT C		TOTAL	
Standby per year	Variable per $100 Net Sales	Standby per Year	Variable per $100 Net Sales	Standby per Year	Variable per $100 Net Sales	Standby per Year	Variable per $100 Net Sales
$1,215,000		$675,000		$810,000		$2,700,000	
45%		25%		30%		100%	
$ —	$8.000	$ —	$12.000	$ —	$14.000	$ —	$10.800
—	55.000	—	30.600	—	48.000	—	46.800
87,110	9.400	86,966	13.344	119,924	15.095	294,000	12.100
$87,110	$72.400	$86,966	$55.944	$119,924	$77.095	$294,000	$69.700
51,030	5.650	38,910	7.650	34,560	6.250	124,500	6.330
24,600	1.320	16,200	1.320	19,200	1.320	60,000	1.320
$162,740	$79.370	$142,076	$64.914	$173,684	$84.665	$478,500	$77.350
	$20.630		$35.086		$15.335		$22.650
$791,000		$405,000		$1,130,000		$2,110,000	
65.0%		60.0%		139.0%		/8.0%	

5 Budget Realization

	100%	95%	90%
Standby per year	$478,500	$504,000	$531,500
Variable per $100 sales	$77.35	$81.40	$85.95
Annual breakeven sales	$2,110,000	$2,705,000	$3,780,000
Pickup per $100 above B/E	$22.65	$18.60	$14.05
PROFIT POTENTIALS			
Annual sales of $2,400,000	$66,000	$57,000*	$194,000*
Annual sales of 2,700,000	134,000	1,000*	152,000*
Annual sales of 3,000,000	202,000	55,000	109,000*
Annual sales of 3,300,000	270,000	111,000	67,000*
Annual sales of 3,600,000	338,000	167,000	25,000*

*Deficit

6 Effect of Changing Product Mix on Breakeven Point and Profits

SELECTED MIXES			
Column (A)	(B)	(C)	(D)
Line (1) Product A	30%	40%	40%
Line (2) Product B	70	20	40
Line (3) Product C	—	40	20
Line (4) Annual standby	$479,000	$479,000	$479,000
Line (5) Var. per $100 net sales (weighted)	$69.25	$78.60	$74.65
Line (6) Marginal profit per $100 net sales	$30.75	$21.40	$25.35
Line (7) Annual B/E sales	$1,550,000	$2,232,000	$1,885,000
Annual Net Sales (in thousands of dollars)	NET PROFIT BEFORE TAXES AT ABOVE MIXES		
Line (8) $1,200	108*	221*	174*
Line (9) 1,800	77	92*	22*
Line (10) 2,400	261	36	130
Line (11)ø 2,700	354	100	207
Line (12) 3,000	446	165	283
Line (13) 3,600	631	293	435
Line (14) 4,000	755	378	536

øProjected Sales
*Loss

7 Effect of Price Reductions on Breakeven Point

SELLING PRICES	Current Level	Reduced 5%	Reduced 10%
ANNUAL BREAKEVEN SALES	$2,110,000	$2,570,000	$3,400,000
At annual sales of:	Projected Profits		
$2,400,000	$66,000	$32,000*	$141,000*
2,700,000	134,000	24,000	98,000*
3,000,000	202,000	80,000	56,000*
3,300,000	270,000	136,000	14,000*
3,600,000	338,000	192,000	28,000

*Deficit

mix, anticipation of future product mixes, and all the other disturbing problems that must be met day by day, month by month, and year by year.

Effect of Change in Selling Price

A change in selling price has exactly the same action on the breakeven point as in increase or reduction in the variable cost, except that it can actually be more severe because it is the whole dollar of sales. It changes the breakeven point and also reduces marginal profit above the breakeven point very seriously. But competitive conditions sometimes induce otherwise foresighted managements to institute price reductions which bring breakeven points perilously close to current sales levels.

For instance, using the Wisconsin Manufacturing Corporation again, Table 7 shows what a 5 or 10 per cent price reduction would do to the breakeven point and profit potentials.

This situation is made even more acute by the fact that reduction in selling prices does not always bring commensurate increases in units sold. Thus, if prices were reduced 10 per cent it is entirely possible that sales would not even be adequate to reach the breakeven point in operation.

(E)	(F)	(G) — Projected 1949 Mix
50%	60%	45%
40	40	25
10	—	30
$479,000	$479,000	$479,000
$74.13	$73.59	$77.35
$25.87	$26.41	$22.65
$1,847,000	$1,810,000	$2,110,000
(in thousands of dollars)		
167*	161*	206*
12*	3*	70*
143	156	66
221	235	134
298	314	200
454	473	337
557	579	428

Establishing a breakeven point becomes a hollow act unless management follows through regularly—daily, weekly, monthly, quarterly—to analyze any variations from the predetermined cost trends. Control of these costs is made simpler when the effect of individual departmental effort on the over-all profit is shown.

For instance, schedules A, B, C, and D, taken from the Wisconsin Manufacturing Corporation, follow the budget performance of the assembly department all the way, from its individual budget report through the profit-and-loss statement and into the analysis of the variations from the profit trend.

Schedule A: The assembly department shows a budget realization of 94 per cent for October, 1948, based on expenses of $3738 as compared to a budget allowance of $3528. The loss in profits was $210 ($3738 less $3528).

Schedule B: The factory departmental summary report to management shows the over-all realization to be 91 per cent for the month. Total expenses were $54,147, while budget allowances totaled $49,392. The arrow indicates the assembly department items that are part of the composite total. Profits were reduced $4755 because of the failure to meet the budget. ($54,147 less $49,392 equals $4755).

Schedule C: The profit and loss statement, under the cost-of-sales section, indicates the standard cost of sales, based on 100 per cent budget realization, to which is added the variations from standard. Included in these variations is the $4755 that represents failure to meet the budget. The selling and administrative expenses shown are actual figures, and the budget realization was 100 per cent, so there was no effect on profits involved in this section. The arrow indicates where the assembly department's expense variation is included in the profit-and-loss statement. Net profits before taxes were $11,793.

Schedule D: Analyzing the profits, management found that the breakeven factors of standby and variable costs indicated that profits should have been $11,227 whereas actually a profit of $11,793 was realized—a favorable variation of $566. Why?

First, a product mix for the year was projected which carried the following weights: product *A*, 45 per cent; product *B*, 25 per cent; and product *C*, 30 per cent. Actually, the net sales, as taken from the profit-and-loss statement, showed a product mix as follows: product *A*, 40.2 per cent; product *B*, 40.9 per cent; and product *C*, 18.9 per cent.

This change in product mix caused the over-all weighted variable to drop from $77.35 (as shown in the breakeven factors) to $74.458 per $100 of net sales, with a resultant reduction in cost of $6514. Yet profits did not reflect this. Why? Let's see.

The second factor that causes variations is performance. As the profit-and-loss statement shows, variations from standard costs amounted to $5948, as detailed in the schedule.

Since the variation of $6514 due to mix was favorable, and the variation of $5948 due to performance was unfavorable, a combination of the two results in a net variation from the trend amounting to $566.

Management must constantly be aware of items of this type. Although a variation of $566 may appear minor, it may be small only as a result of the counterbalancing of several major factors. By keeping a weather eye cocked on fluctuations in product mix, and by staying in constant touch with day-to-day operations through use of budget reports, management can accomplish its job of making profits, and, more important, of knowing *why* profits are where they are.

Additional illustrative tables are shown on the following pages. The text of the article continues on page 107.

A **Factory Budget Report**

600	Direct Labor – Incen.	5,528.19					
601	Direct Labor – D.Work	–			Dept. No. 5		
602	Direct Labor – Set-up	–			Dept. ASSEMBLY		
603	Incen. Bonus & P.A.	–			MONTH Ending 10/31/48		
	TOTAL DIRECT LABOR	5,528.19	Base: OWN DIRECT LABOR		Date Issued 11/5/48		
Acct. No.	Account Name	Actual Expense			Budget ($ only)	% Budget Realization	
		Labor	Other	Total		Current	Last month
610	Supervision	517.20		517.20	503	97	100
611	Clerical						
612	Truckers	195.50		195.50	179	92	81
613	Janitors & Sweepers	344.11		344.11	341	99	86
614	Watchmen						
615	Overtime (Prem. only)	19.79		19.79	–	–	–
616	Lunch & Washup	260.41		260.41	260	100	98
617	Vacations						
618	Retroactive Payroll						
714	Group Insurance		100.35	100.35	100	100	100
715	License Tags						
716	Social Security & Unempl.		165.19	165.19	165	100	100
717	Real & Personal Taxes						
	TOTAL EXPENSE	2,089.68	1,648.33	3,738.01	3,528	94	93

B **Factory Departmental Summary**

600	Direct Labor – Incen.	24,178.13					
601	Direct Labor – D.Work	–			Summary - FACTORY		
602	Direct Labor – Set-up	329.77			Depts. 1 Through 10		
603	Incen. Bonus & P.A.	–			MONTH Ending 10/31/48		
		24,507.90			Date Issued 11/5/48		
Dept. No.	Dept. Name	Actual Expense			Budget ($ only)	% Budget Realization	
		Labor	Other	Total		Current	Last month
1	Machine Shop	2,799.08	2,332.11	5,131.19	4,870	95	102
2	Grinding	2,172.92	1,044.78	3,217.70	3,329	103	104
3	Forging	304.74	668.79	973.53	940	97	89
4	Foundry	1,071.16	948.61	2,019.77	1,667	83	92
5	Assembly	2,089.68	1,648.33	3,738.01	3,528	94	93
	TOTAL - PROD. DEPTS.	8,437.58	6,642.62	15,080.20	14,334	95	96
6	Engineering	2,579.80	4,295.25	6,875.05	6,441	94	90
7	Factory Accounting	3,117.65	213.25	3,330.90	2,659	80	82
8	Maintenance	2,994.86	2,982.81	5,977.67	5,145	86	83
9	General Works	7,407.32	9,305.06	16,712.38	14,411	86	87
10	Rental	495.17	5,675.37	6,170.54	6,402	104	99
	TOTAL - NON-PROD. DEPTS.	16,594.80	22,471.74	39,066.54	35,058	90	89
	TOTAL – FACTORY	25,032.38	29,114.36	54,146.74	49,392	91	90

C **Profit and Loss Statement —** OCTOBER, 1948

SALES:	Product A	$90,606.00	
	Product B	92,258.00	
	Product C	42,750.00	
	TOTAL NET SALES		$225,614.00
COST OF SALES: At standard			
	Labor	$24,304.60	
	Material	98,584.50	
	Burden	51,781.90	
	TOTAL STANDARD COST		$174,671.00
	Variations from standard		
	Material price variation	$1,075.50	
	Freight variation	117.50	
	Underabsorbed burden		
	Due to volume	—	
	Due to performance	4,754.74	
	TOTAL COST OF VARIATIONS		5,947.74
	TOTAL COST OF SALES		$180,618.74
GROSS PROFIT			$44,995.26
OTHER EXPENSES:	Selling expense	$25,223.86	
	Administrative expense	7,978.10	
	TOTAL OTHER EXPENSE		33,201.96
	NET PROFIT BEFORE TAXES		$11,793.30

D **Analysis of Profits —** OCTOBER, 1948

Actual profits			$ 11,793
Profit — projected from profitgraph			11,227
Net variation from profitgraph			$ 566 ✓
Net sales during month			$225,614
Variation due to product mix:			
Costs at projected product mix			
(45% Product A; 25% Product B; 30% Product C)			$214,387
Costs at actual product mix			
(40.2% Product A; 40.9% Product B; 18.9% Product C)			207,873
Favorable variation due to mix of product			$ 6,514
Variation due to performance			
Material price variations		$1,075	
Freight variations		118	
Underabsorbed factory burden:			
Due to volume	—		
Due to performance	4,755	4,755	
Variations from budget:			
Selling expense	—		
Administrative expense	—	—	
Total variations due to performance			$ 5,948
Net variation from profitgraph on which breakeven is set up			$ 566 ✓

8 Statement of Capitalgraph Factors

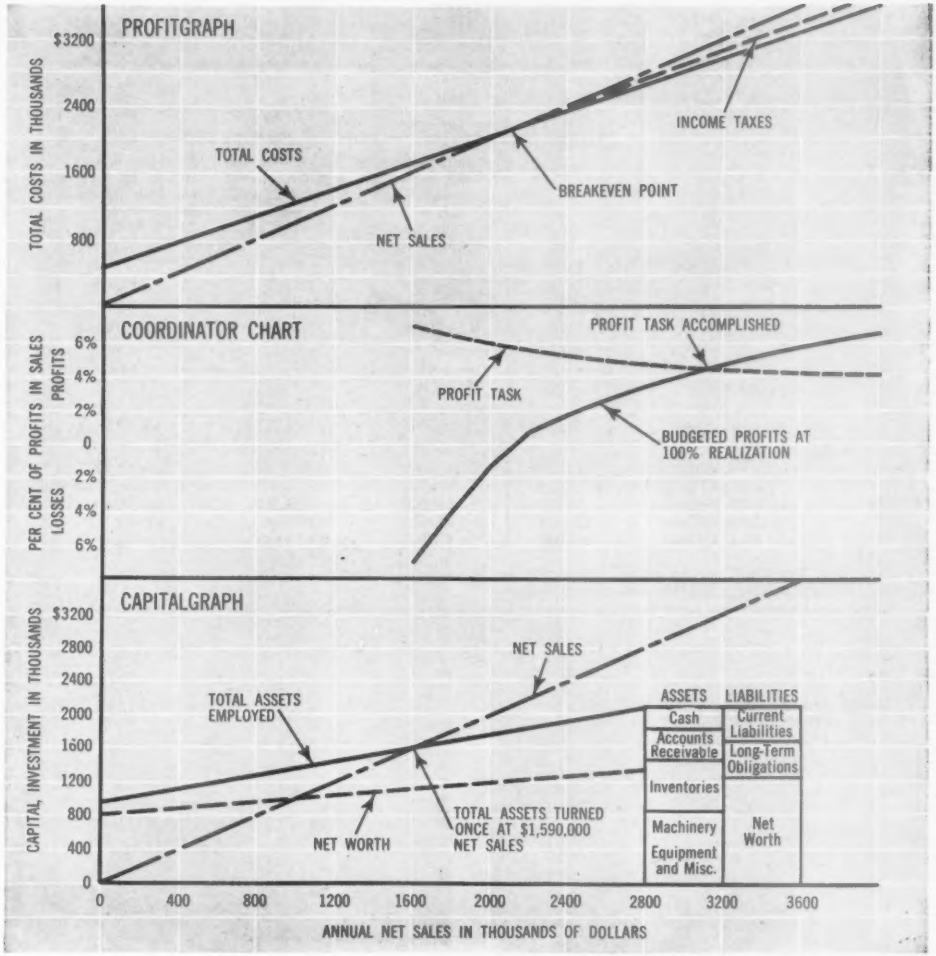
		Basic or Stand-by Investment	Variable Investment per $100 of Sales
ASSETS	Cash	$50,000	$4.45
	Accounts receivable		9.06
	Inventories	200,000	19.45
	Total current assets	$250,000	$32.96
	Machinery, equipment, & miscellaneous	725,000	5.56
	TOTAL ASSETS	$975,000	$38.52
LIABILITIES	Accounts payable	$50,000	$4.17
	Miscellaneous accruals	25,000	3.89
	Total current liabilities	$75,000	$8.06
	Long-term obligations	100,000	11.10
	Net worth	800,000	19.36
	TOTAL LIABILITIES	$975,000	$38.52

9 Co-ordinated Investment Costs and Profits †

PROFIT TASK				BUDGETED PROFITS AT 100% REALIZATION							
Fixed Net Worth	Variable Net Worth	Total Net Worth	% Profit Required to Produce 10% Return	Annual Net Sales	Annual Standby	Annual Variable Costs	Total All Costs	Profit Before Taxes	Estimated Income Taxes	Net Profit After Provision for Income Taxes	% of Net Profit in Sales
$800	$310	$1,110	6.9%	$1,600	$479	$1,236	$1,715	$115*	$ —	$115*	7.2%*
800	348	1,148	6.4	1,800	479	1,391	1,870	70*	—	70*	3.9*
800	387	1,187	5.9	2,000	479	1,547	2,026	26*	—	26*	1.3*
800	426	1,226	5.6	2,200	479	1,700	2,179	21	8	13	.6
800	464	1,264	5.3	2,400	479	1,854	2,333	67	27	40	1.7
800	502	1,302	5.0	2,600	479	2,009	2,488	112	45	67	2.6
800	541	1,341	4.8	2,800	479	2,163	2,642	158	63	95	3.4
800	580	1,380	4.6	3,000	479	2,319	2,798	202	81	121	4.0
800	619	1,419	4.4	3,200	479	2,474	2,953	247	99	148	4.6
800	658	1,458	4.3	3,400	479	2,627	3,106	294	118	176	5.2
800	697	1,497	4.2	3,600	479	2,782	3,261	339	136	203	5.7
800	735	1,535	4.0	3,800	479	2,937	3,416	384	154	230	6.1
800	774	1,574	3.9	4,000	479	3,094	3,573	427	171	256	6.4

* Indicates loss, deduction, or other negative figure

† In millions of dollars



IV • Maintaining Return on Investment

The application of standby and variable factors as a working tool of cost control and profit analysis has led also to the correlation of these factors with the problem of a "proper" return on investment. Therefore, the approach of management should be this:

1. What are my profit possibilities?
2. What are my investment requirements?
3. At what volume will the profit produced equal a normal return on the required investment?

With a complete knowledge of the principles of "basic standby" (or float) and "variable investment required," management can successfully interpret the relationship of the various components of the balance sheet, and correlate these components with costs and the proper return on the assets employed.

Using the same principles of standby and variable costs described in the discussion of cost trends, management can determine what its working capital requirements are at any given level of business, as well as the total net worth necessary to maintain that volume.

The Wisconsin Manufacturing Company has, through detailed correlation of sales *versus* assets, liabilities, and net worth, found its net capital requirements to be those shown in Table 8.

A review will indicate that management's job, as expressed in the *net worth requirements* of the company, is to produce $800,000 of basic net worth (float), plus $19.36 per $100 of sales. It is also management's responsibility to maintain the investment picture at the stated dynamic ratios because anything less does not produce adequate capital, and anything more will make the task of attaining a proper yield on investment more difficult.

Referring to the capital requirements as shown

10 Effect of Capital Expenditures on Breakeven Point

	CURRENT PROFITGRAPH	METHOD OF FINANCING USED — REVISED PROFITGRAPHS		
		1. 20-year loan at 4% interest for $1,000,000	2. 15-year loan at 4% interest for $750,000. Use working capital for balance.	3. 10-year loan at 3% interest for $500,000. Use working capital for balance.
Standby per year	$478,500	$668,500	$658,500	$643,500
Variable per $100 sales	$77.35	$67.41	$67.41	$67.41
Annual breakeven sales	$2,110,000	$2,050,000	$2,020,000	$1,970,000
Profit pickup	$22.65	$32.59	$32.59	$32.59
Available working capital	$1,050,000	$1,050,000	$800,000	$550,000
Working capital sufficient for annual sales capacity of	$3,500,000	$3,500,000	$2,500,000	$1,500,000
Profits or Losses at				
$1,500,000 Sales	$138,000*	$179,000*	$169,900*	$153,000*
2,000,000 Sales	25,000*	16,000*	7,000*	
2,500,000 Sales	88,000	147,000	156,000	Insufficient working capital
3,000,000 Sales	202,000	310,000	Insufficient working capital	
3,500,000 Sales	315,000	475,000		

Note. The W.M.C. working capital requirements are $175,000 standby, plus $24.90 for $100 sales volume

*Deficit

above and the profit factors previously shown, we are now able to calculate the following facts at *various sales levels* (see Table 9):

1. Total investment required.

2. *Profit task* (a 10 per cent return on net worth) expressed as a percentage of profit required in sales.

3. Total of all costs.

4. Net profit after provision for taxes.

5. *Profit possibilities*, expressed as a percentage of sales.

A graphic illustration of these figures appears on the chart (preceding page), which shows the "profitgraph," "capitalgraph," and "coordinator chart." The coordinator chart pictures the profit task of management in a manner which is easy to digest, for the casual outsider, as well as the not-so-casual stockholder.

An important consideration in cost reduction is: *When should capital money be spent in order to reduce costs?* If the purchase of new equipment must be financed through available working capital, such expenditures become inadvisable when they bring the available working capital down to a level that cannot support the projected sales volume. Analysis may indicate that the purchase can be most advantageously financed by a loan from outside sources. In any case, these factors must be considered in relation to their effect on the breakeven point:

1. Changes in variable costs through lowered labor, material, and burden requirements.

2. Added liabilities (standby) incurred through interest and repayment of any borrowed capital.

3. Added depreciation and possible obsolescence.

4. Revised working capital position, expressed in financial capacity to do business.

Weighing all these factors, management can measure its calculated risk by answering these questions: *What will it do to my breakeven point? What will it do to my pickup above the breakeven point? Will I be in a financial position to support the projected sales volume?*

The Wisconsin Manufacturing Corporation, for instance, can purchase $1,000,000 of new equipment, and through its use reduce total variable costs by $9.94 per $100 of sales. Three channels are open to management as a means of financing the purchase:

1. A 20-year $1,000,000 loan at 4 per cent interest.

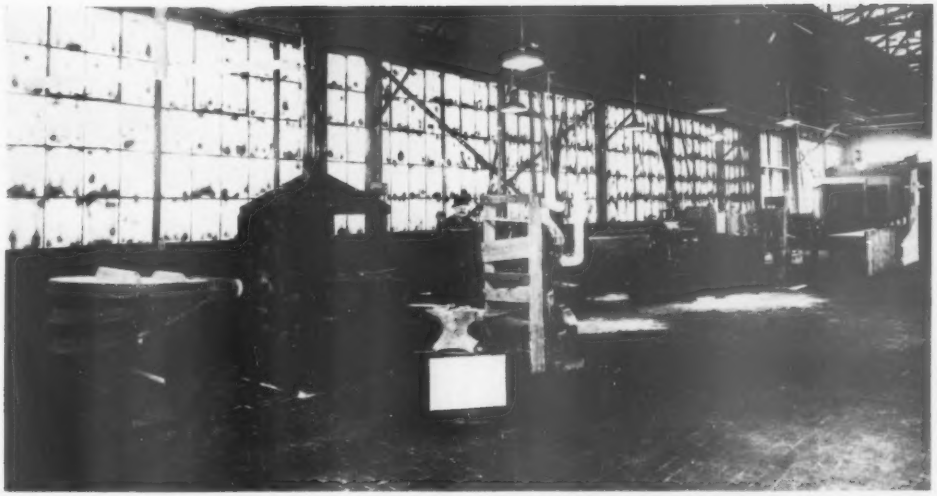
2. A 15-year $750,000 loan at 4 per cent interest.

3. A 10-year $500,000 loan at 3 per cent interest.

In the latter two cases, the balance of the purchase would be financed through use of available working capital. How it would work out is shown in Table 10.

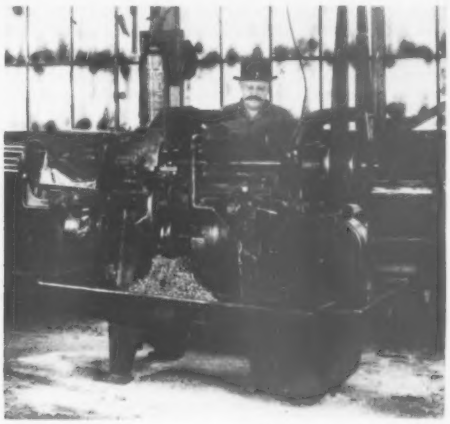
Using up working capital, even though it does result in a slightly lower breakeven point, jeopardizes the future operations through lack of funds to maintain production levels at the projected point. It is through coordination of both the profitgraph and capitalgraph that management is able to estimate the calculated risk involved in future decisions. Thus we see that breakeven points are extremely valuable in setting long-term policies, in determining selling price, capital expenditures, and capital requirements.

Management can no longer be satisfied with static measures of control. To define and comprehend the problems that confront management in its important cost-reduction job, standby and variable factors to measure profit potentials are essential.



FIRST TIMKEN BEARING SHOP AS IT EXISTED AT TURN OF THE CENTURY WAS REPRODUCED AS OPEN HOUSE FEATURE

OLD-TIME MACHINES USED TO DRAMATIZE PROGRESS



OPERATORS WERE MEN WITH 35 YEARS OF SERVICE

Re-creates 1900 Shop at Open House

How MUCH have working conditions and production methods improved in the past 50 years?

Timken Roller Bearing Company, Canton, Ohio, presented a living answer to that question as part of its open house, June 20-24. It created a replica of its first bearing shop, just as it existed at the turn of the century, and manned it with employees dressed in the costumes of the period.

Several employees with more than 35 years' service were called on for technical advice. Machines long since discarded as obsolete were rehabilitated to permit actual production. An old-time steam engine was reactivated to supply power for the maze of overhead shafts. A hand-operated bellows was located for the forge. The shop's original anvil was pressed into use again. Windows were purposely dirtied to give an authentic atmosphere.

The thousands who visited the exhibit saw an operator take 3 to 4 minutes to assemble a bearing. These visitors could appreciate the strides private enterprise has made in a half century when they entered the modern plant and saw vastly improved bearings being made, with far less effort, at the rate of 300 to 600 an hour.

1. NEW WORKER Maurice Bartell gets badge from personnel clerk. He is then directed to the plant assembly room for the start of the induction program

2. WELCOME TO BOEING is given Maurice and other new workers. Session usually lasts 60 to 90 minutes. Here Maurice learns about company benefits, policies,

New Workers Spend First Day Learning Company Facts

4. APTITUDE TESTS next. They take 2½ hours. Blueprints, math, electricity, materials, nomenclature, hydraulics, tool identification, stationing are covered

5. PLANT TOUR follows luncheon recess. The tour gives Maurice the over-all picture. After this, it is very easy to show him just how his own job will fit in

and rules. He is encouraged to ask questions. If he has housing or money problems, or other troubles, he learns where he can get some assistance in solving them

3. SOUND MOVIE in color tells Maurice about the founding of the company, its development, its products, and its safety procedures. The film runs 40 minutes

Boeing Airplane Company, Seattle, has streamlined its induction program to a single day. Objectives: (1) Put new workers at ease; (2) give them facts they need; (3) find the job each can do best. Result: Turnover on downgrade; new workers start producing faster, do better work. Short, well-planned induction pays off.

6. INTRODUCTIONS to supervisors come next day. First Maurice meets general foreman. Job assignment is now made on the basis of experience and test scores

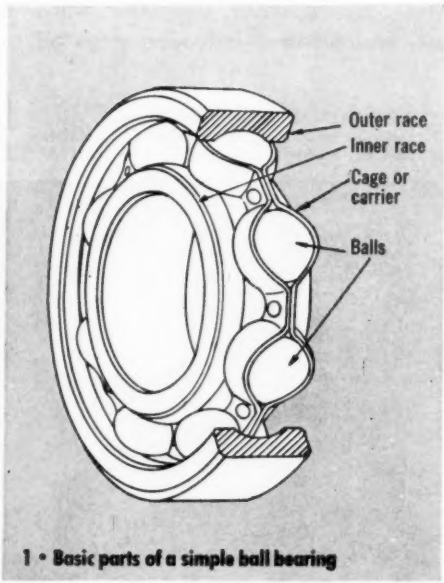
7. ON-JOB TRAINING follows introductions. Assistant foreman is instructor. He begins by explaining the purpose of the equipment Maurice will install

Guide for Maximum Relubrication Periods for Ball-Bearing Motors (203-505 Frames, 514-3600 RPM)

	Horsepower ¼-7½	10-40	50-150
STANDARD SERVICE			
Machine tools Air-conditioning apparatus Conveyors, 1 or 2 shifts Garage compressors Refrigeration apparatus Laundry machinery Textile machinery Oil-well pumping Wood-working machines Water pumping	5 years	3 years	1 year
VERY SEVERE			
Dirty, vibrating applications Where end of shaft is hot (pumps and fans) High ambient	6 months	3 months	3 months

	Horsepower ¼-7½	10-40	50-150
SEVERE			
Motors running 24 hr./day-365 day/yr. Fans, 24 hr./day-365 day/yr. Pumps, 24 hr./day-365 day/yr. M-G sets, 24 hr./day-365 day/yr. Coal and mining machinery Motors subject to severe vibration Steel mill service	3 years	1 year	6 months
EASY			
Valves Door openers Portable floor sanders Motors operating infrequently (1 hr./day)	7 years	5 years	3 years

Lubricating Ball-Bearing Motors



1 • Basic parts of a simple ball bearing

A. F. LUKENS • SMALL & MEDIUM MOTOR DIVISIONS, GENERAL ELECTRIC COMPANY SCHENECTADY, N. Y.

PROPERLY DESIGNED MOTORS with grease-lubricated ball bearings in general have long life, even under adverse operating conditions. It is our recommendation, however, that the ball bearings be greased at intervals commensurate with their size and service in order to realize the full reliable life of the motor. This recommendation is based on field experience and many tests that indicate that long and efficient operation depends on:

1. The type of grease used
2. The size and speed of the bearing
3. The hours of service
4. The severity of service

The table shows the recommended frequency of lubrication for various sizes of motors operating in services of different degrees of severity.

A construction capable of being regreased will give as long life between relubrications as any other type, under given circumstances. In addition, if there are convenient means of relubrication when this becomes necessary, the motor can be kept in service without disassembly or replacing the bearings.

Figure 1 shows a cutaway view of the simplest ball

bearing used in electric motors. It consists of four parts: (1) the inner race; (2) the outer race; (3) the cage, also called spacer or carrier; (4) the balls. The inner race is mounted on the shaft, while the outer race is carried in the endshield. As the shaft revolves, the balls rotate around their own axes and also about the center of the shaft. In addition, the balls may slide to a slight extent on the races. The balls slide in the cage as they rotate, and in some large bearings the cage may rest against the inner race and slide over it as the shaft rotates.

The unit pressure of the balls against the races is extremely high (in hundreds of thousands of pounds per square inch) so that the lubricant to a great extent is squeezed out of the contact area. Therefore, the type and amount of lubricant are not particularly important, as far as the balls and races are concerned, except as they prevent corrosion. On the other hand, the lubricant is all-important in the lubrication of the sliding contacts between the cage, balls, and races. Generally speaking, the grease lubricates only the cages and keeps the balls and races from rusting.

The balls and races are made of very hard (Rockwell C62) special, heat-treated steel. Balls are ground so that the out-of-roundness does not exceed about 0.000025 of an inch. Individual balls are matched to about 0.00005 of an inch average diameter.

Grooves of the races are ground to commensurate tolerances.

Other tolerances that affect the quality of the bearing are the diameter and roundness of the bore and outside diameter, the eccentricity of the grooves and outside of the races, and the perpendicularity of the grooves and the outside of the races.

The clearance between the balls and the races is sometimes known as fit-up, or internal clearance. This is a critical factor that is carefully specified, since it depends on the bearing itself and on the diameter of the shaft, which is measured in ten-thousandths of an inch. If the fit-up is too loose, the bearing may rattle; if too tight, it may squeal and fail prematurely.

Ball bearings can fail in many ways and from various causes. The most common causes are:

1. Dirt in the bearing, which dents or laps and mars the races

2. Overloading, which causes the races and balls to flake off or crack

3. Wear of the cage, which often culminates in its breaking up and jamming between the balls

4. Hardened grease, which may lock the bearing and prevent rotation or cause fracture of the cage

Causes of bearing failure · Dirt in a bearing is the result of faulty manufacture or faulty maintenance. The parts were not clean when assembled, or dirt was injected when the bearing was greased. This cause of failure is not often found.

Flaking is caused by skimpy selection or an overload. Since bearings for well-designed motors are selected on a very conservative basis and are large enough to withstand overloads for long periods, this cause of failure is rarely found in such motors.

The life, in number of revolutions, that a given bearing will have varies inversely as the cube of the load. Life also is expended at a faster rate with higher speeds; therefore, for a given life the load must be reduced as the speed is increased. This fact explains why an apparently insignificant change in bearing size can so greatly change the life expectancy.

The third type of failure, cage wear, is caused almost entirely by faulty lubrication. The cages run dry for one reason or another, wear, and eventually break up. This is by far the most common cause of failure and the one that can be avoided by proper lubrication and relubrication.

Grease becomes hard when it is subjected to high temperatures or is worn out. Under some adverse conditions it becomes so hard that it locks the balls when the motor is at rest, and prevents rotation of the shaft. If enough torque is applied to the bearing the cage may be fractured.

This type of failure is seldom found, except when the grease is run to destruction either through lack of relubrication or exposure to too high a temperature.

Greases · Grease is a mixture of soap or soaps, oil, and sometimes small quantities of other ingredients. The soaps may have different metallic bases: calcium (lime base), sodium (soda base), lithium, and aluminum are the most common. Additive components control the rate of chemical action, and affect the life of the grease. The addition of an anti-oxidant in the past few years is perhaps the most important factor that has made it possible to increase the time between relubrications.

Up to the present, no one seems to have been able to write a specification for grease that defines it accurately solely by physical or chemical terms. For this reason greases are selected on a "sample-and-test" basis.

The generally accepted theory of grease lubrication is that the soap holds the oil, somewhat like a sponge, although chemically and not physically. The oil is allowed to bleed out at a rate just sufficient to lubricate the bearing parts properly, and not so fast that any oil is wasted. Thus, the free oil is credited with the major part of the lubrication.

When the oil is exhausted, the grease is "dead." Only the soaps remain, either as a gummy mass, or a dry, cracked cake. The life of the grease is determined by the temperature, the amount of working—which depends on the size and speed of the bearing—and the length of time in use, as well as its physical and chemical composition.

As the oil gradually leaves the grease, the composition of the remaining part is changed. Usually the grease bleeds less and less oil. In some cases, however, as the grease approaches the end of its life, the bleeding rate may be greatly accelerated, so that all the remaining oil is dumped. When this happens, the oil is given off at too fast a rate and is wasted, usually by leaking out of the housing.

Oxidation plays a large part in this sudden change in the characteristics of the grease, and a change in acidity is an indication of its approach. The addition of an anti-oxidant greatly extends the period of constant bleeding and the useful life of the grease.

Special greases sometimes are used to meet special requirements such as extremely low- or high-temperature operation. It should be kept in mind, however, that some standard greases are suitable for operation in a range from minus 30 degrees to 175 degrees Fahrenheit.

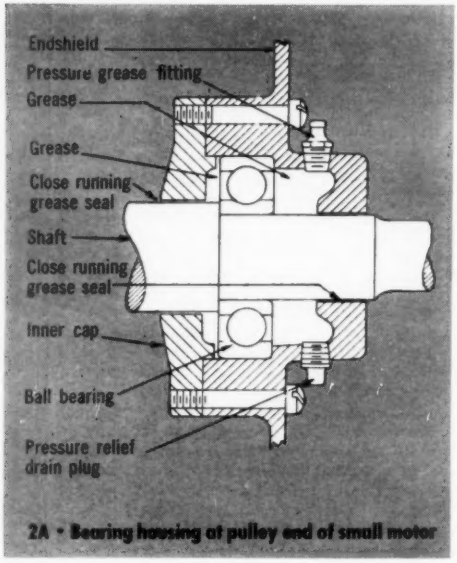
From the preceding, it can be seen that when a

bearing is conservatively selected and properly mounted, its life is in fact measured by the life of the grease.

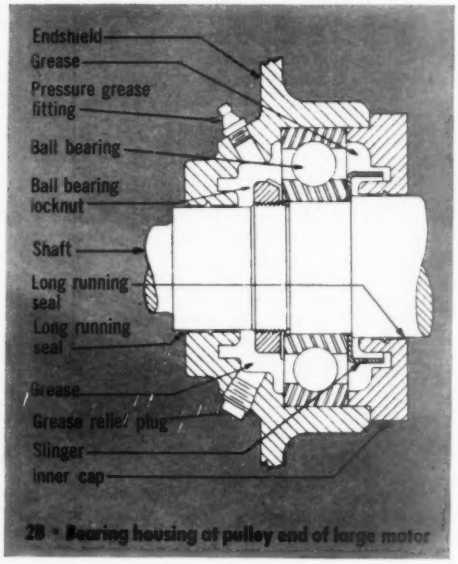
Bearing housings • The bearing shown in Figure 1 is incomplete, since it has no housing to hold the grease around it. In general, the housing consists of a chamber that contains the bearing and the grease, with the shaft passing through or entering it. It must prevent grease from leaking out, and dirt from entering. Its size and shape are important.

The housing may be made in part by the bearing manufacturer, as with the so-called sealed and shielded bearing, or by the motor manufacturer.

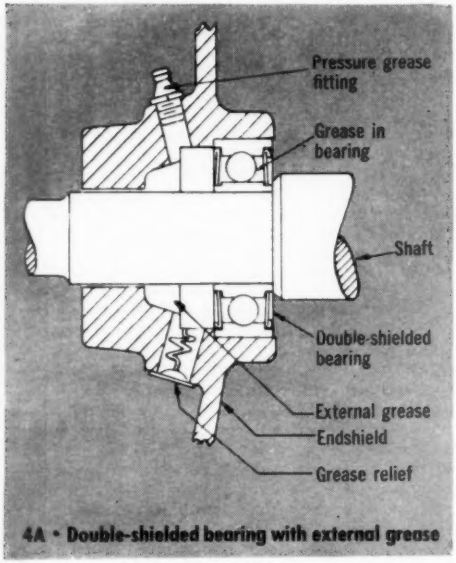
Figures 2A and 2B show typical polyphase induction motor bearing housings, for small and large motors,



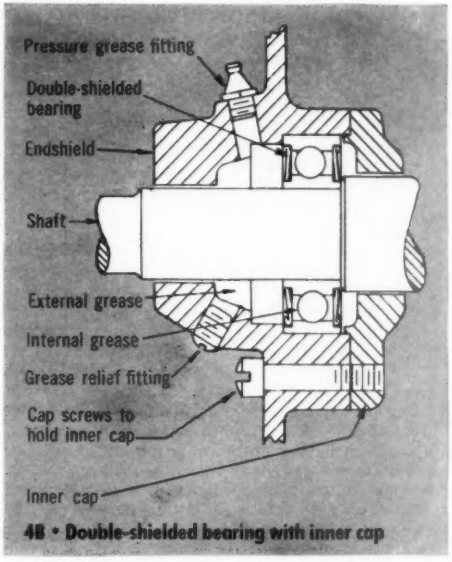
2A • Bearing housing at pulley end of small motor



2B • Bearing housing at pulley end of large motor



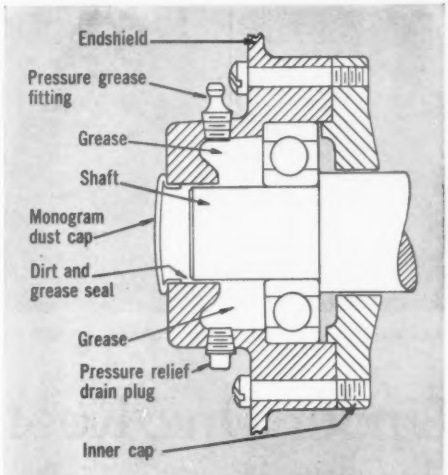
4A • Double-shielded bearing with external grease



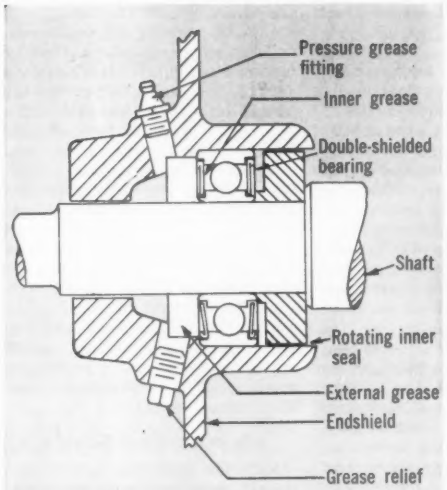
4B • Double-shielded bearing with inner cap

respectively. In both, the outer race of the bearing is supported in a machined seat in the endshield, which holds it concentric and straight. It is assembled with a light push fit. The endshield casting is carried down to form the nose of the housing, through which the shaft extension passes.

The running seal, which has no rubbing or wearing parts, keeps the grease in and the dirt out. It is formed by the relatively long and close clearance between the shaft and housing. Experiment has shown that the length of the seal, that is, the thickness of the casting at that point, is important in making a suitable seal. For motors used in extremely dirty locations—for example, Class II, Group G hazardous dust locations—an additional revolving slinger or labyrinth seal is used.



3 • Bearing housing at opposite end of small motor



4C • Double shielded, with rotating inner seal

In these designs the bearing cap on the inner side of the endshield forms the inner seal and has the same long, or even longer, close-fitting rotating seal around the shaft.

Figure 3 shows a design in which the shaft is extended into the endshield. This construction forms a seal to prevent the entrance of dirt, even though the monogram dust cap is lost.

Figures 4A, 4B, and 4C show a single-row, double-shielded bearing in various types of mountings. Such a bearing is given different names by the various bearing manufacturers. A basic bearing, as in Figure 1, is fitted with two steel plates, one on each side of the balls. The cavity is filled with grease by the bearing maker. The working parts of the bearing—balls, races, and cages—are exactly the same as those of the simple bearing used in the housing of Figures 2A and 2B, although this bearing is available only in the smaller sizes.

When the double-shielded bearing is mounted in a cavity with additional grease around it (Figure 4A) it gives long, satisfactory life in the smaller sizes. The small opening between the shield and the inner race allows the external grease, or possibly only the oil of the grease, to work into the bearing and replenish the lubricant around the balls. The shield acts as a barrier and tends to keep any dirt in the grease from entering the bearing.

The addition of an inner cap, Figure 4B, further protects the bearing, and makes it possible to pack grease on both sides of it. Such a housing can be lubricated while running, without the danger of grease leakage into the motor.

Figure 4C shows a modified housing that may be used where the holding bolts of the cap interfere with some other part. This design has given successful operation on arc welder sets.

Relubrication recommendations • This background boils down to the fact that bearing size and service determine the life of the grease, and hence the periods between relubrication.

One point that should not be overlooked is the reliability of service expected or needed. If a whole process, or the operation of a complex machine, depends on the continued operation of a small motor, it is common sense to relubricate at relatively short periods. On the other hand, if greasing is a difficult job, and a possible shutdown is not particularly inconvenient, common sense again dictates setting relubrication periods at the maximum.

The rules for lubrication and relubrication of ball-bearing motors for long life are simple, but they should be followed consistently:

1. Relubricate at periods in accordance with the type, size, and service of the bearing. Remember that these periods are relatively long for the less-severe applications.
2. Use good ball-bearing grease.
3. Keep the grease clean.

MAINTENANCE BUILDING IN CENTRAL LOCATION HAS SEPARATE WORKROOM, OUTSIDE ENTRANCE FOR EACH CRAFT . . .

All Maintenance Under One Roof

Besides yielding direct economies in repair costs, quicker repairs also mean less downtime and more production, hence lower manufacturing costs

WALTER P. KRONQUIST • MASTER MECHANIC, KEYSTONE STEEL & WIRE COMPANY, PEORIA, ILL.

A NEW AND WELL-EQUIPPED maintenance building at Keystone has cut in half the time required for repair operations in maintenance of its plant and equipment. Consolidation under one roof in a central location, of various crafts formerly scattered in various small buildings throughout the 125-acre plant has resulted in more efficient work and improved quality of work. In due time the cost of $190,000, which includes $25,000 in added equipment, will be amply repaid by the savings.

Fireproof construction also was a major objective, to provide safe quarters for workmen and to protect the many valuable parts in the new storeroom. The building is of two-story, steel-frame design, with concrete floors, steel sash, and double brick curtain walls. Roof is poured gypsum with felt and asphalt covering. Interior partitions are building tile. The plot measures 80x140 feet. Several interior stairways connect the two floor levels.

Each craft or related group has its own separate quarters, accessible by large outside entrance doors that eliminate interdepartmental traffic.

Actual floor area allocations for the various crafts and services are: (1) machine shop, for 25 machinists, welders, and riggers—4000 square feet; (2) 4 carpenters and 1 painter —1480 square feet; (3) 7 pipefitters —800 square feet; (4) 18 yardmen and masons—800 square feet; (5) 10 electricians—1600 square feet; (6) two storerooms—6400 square feet; and (7) washroom, locker room, and lunchroom—3200 square feet. The manpower count does not include other craftsmen, inspectors, motor room operators, firemen, and engineers stationed elsewhere, making a total of 139 maintenance employees served by this building.

Selection of craft quarters was based on keeping all heavy work on the first floor and placing personnel facilities preferably on the second floor for cleanliness sake. The first floor contains the machine shop (40x100 feet) and carpenter shop (40x37 feet) along one side, and a storeroom and toolroom (40x100 feet), room for yardmen and masons (40x20 feet), and pipefitters' room (40x20 feet) along the other side. A fireproof oil-house enclosure, about 21x26 feet, is located in the far end of this storeroom area. The second floor contains another storeroom (40x60 feet) directly over the lower storeroom, electrical shop (40x40 feet), and employee facilities (40x80 feet). Office enclosures were provided in the machine shop, electrical shop, and storeroom.

Efficient Materials Handling

Materials handling was a consideration in the design and layout of the building. To this end the machine shop ceiling is two stories high, and the electrical shop was

PROVIDES CLEAN, ATTRACTIVE, AND COMFORTABLE EMPLOYEE FACILITIES . . .

EASIER MATERIALS HANDLING . . .

Halves Repair Time

placed at the far end on an open mezzanine directly over the carpenter shop. A five-ton bridge crane of 40-ft. span runs the entire 140-ft. length of the building over both departments. Thus, when equipment is dismantled on the machine shop floor the crane can lift off heavy motors and ride them up to the electrical mezzanine for repair and storage until reinstallation. This crane also handles all heavy loading or unloading for the storeroom. Heavy materials are moved to the job by tractor or cart.

A depressed driveway outside the storeroom permits truck-level loading and unloading. A one-ton monorail hoist is used to lift materials—usually slow-moving or light parts—through a hatch from the lower to the upper stockroom. Here they are carried on a monorail that runs the length of this room.

Adjustable steel shelf bins are used throughout these storerooms. There are two separate disbursement windows between the storeroom and machine shop for tools and general issue, and a wide interconnecting door for large pieces. Lumber and pipe are stored outside in covered racks.

Good working conditions also were sought, as a recognized influence on worker efficiency. Mercury-vapor lighting was installed in the high-bay machine shop area. Unit heaters are scattered throughout the building. Power ventilators keep the air clean in the machine shop section and locker room. Steam, gas, and compressed air are supplied from the plant system.

Employee Facilities

Washroom and locker room have glazed tile walls. Hot water is instantly available for washing and showers. Adequate table and bench space is provided for lunch-carriers.

Additional machine tools have made it possible to handle almost any repair job. In the machine shop, for example, there are now three engine lathes, a boring mill, milling machine, keyseater, hydraulic press, shaper, three drill presses, and a power saw.

To fill a special need, a railroad track spur leads into the machine shop, where a sub-level service pit enables workmen to service a plant locomotive within the building.

Given such good working conditions, the maintenance department feels it belongs to the family and produces accordingly.

EFFICIENT MACHINE TOOLS . . .
AND SAFE STORAGE FOR PARTS

STUDY is provided by 3-hour sessions several times a week in such fundamental and advanced subjects as applied mathematics, shop science, applied mechanics, and strength of materials. Embryo electricians supplement the usual 1200 hours of study with 2 hours of laboratory practice weekly

Maintenance Apprentice Plan

H. L. HAYDEN • WORKS ENGINEER, ARLINGTON (N. J.) WORKS
E. I. DU PONT DE NEMOURS & COMPANY, INC.

WHAT IS THE SENSE of giving a maintenance craftsman the best in tools and equipment if he is not proficient in using them? The Du Pont Arlington Works asked this question of itself fifteen years ago. It is answering the problem by a 4-year maintenance apprentice plan that is now a full-scale program.

At the beginning, management foresaw that modern industrial developments require maintenance men who are not only versatile and skilled as craftsmen but also of high-level technical ability and education. It therefore sought to develop young men who could put an engineer's blueprints and specifications into operation—men who would know the what, why, and how of doing a job. These are the kind of men the apprentice program is now regularly producing.

It costs the company about $1800 for every man completing the course. But it's worth it. Each graduate is certified to be a first-class craftsman, and can vie with the skilled craftsmen who have been with the company for years. Moreover, his special but broad

TRAINING on-the-job involves about 6800 hours of shop work with a master craftsman, closely supervised by a maintenance foreman

The Plastics Department
Arlington Works
of
E. I. du Pont de Nemours & Company
has this
Certificate of Apprenticeship
declares that
Richard A. Fox
has satisfactorily completed the prescribed Apprenticeship Course
of four years with this Company and has received the
requisite practical training to fit him as a Journeyman
Tinsmith
In Testimony thereof this Certificate is duly signed and issued this
nineteenth day of January, one thousand nine hundred
and forty eight.

DIPLOMA is given every graduate upon completion of the 4-year training course, certifying his qualifications as a journeyman in his craft

Develops Skilled Craftsmen

training makes him the best potential for a future supervisory position. Already one graduate has become an area engineer, two are craft foremen, one is general foreman of the electrical group, and another an engineering draftsman.

The qualifications are simple but rigid. Candidates must be graduates of accredited high schools or possess equivalent education. They must pass the physical examination for employment at the plant, and be between 16 and 20 years of age. The age limit has been waived for ex-servicemen, who understandably predominate in the last few years. But ex-servicemen, too, have been found enthusiastic and responsive. It is only the very exceptional helper who can qualify for the apprentice training program.

Today there are 22 apprentices at some point varying from the freshman to the senior part of the course. A total of 52 have been graduated, of whom 20 are still with the company. Normally five or six applicants start each year.

Apprentices are not bound to continue employment with the company upon graduation. But they usually find it desirable and attractive to do so. Likewise, employment is not guaranteed by the company, but if it cannot use a graduate it will make a special effort to place him elsewhere.

The apprentice plan offers

courses to train apprentices as pipefitters, electricians, metalsmiths, machinists, and instrument repairmen. These are the crafts which it is felt can profit most from special training. A proper balance is sought among applicants for these crafts to meet company needs. Today there are eight electricians on the way, six machinists, four pipefitters, and two each of metalsmiths and instrument repairmen, in a total mechanical group of approximately 170 men.

Careful Selection

Selection of new apprentices is a careful procedure. The company believes mistakes hurt both parties. Twice yearly, during March and September, enrollments are accepted. In the intervening months applicants are placed on a waiting list. The administrative duties are handled throughout by a training coordinator who interviews each applicant, explains the program, and prepares an application form.

Applicants are next examined for intelligence, mental alertness, and mechanical comprehension. These tests are administered by the county vocational school, which also participates in the training program. The Schorling arithmetic test is used to determine the proficiency of the applicant's knowledge of fundamentals of arithmetic. The Bennet mechanical comprehension test establishes his ability to comprehend mechanical principles. The Otis "Gamma" test determines I.Q. and "learnability."

Experience has shown that over 75 per cent of the applicants fail to meet the test standards. Each unsuccessful candidate is informed of the nature of his failure and given sympathetic counseling.

The successful candidates then appear singly before the mechanical department's selection committee, composed of the works engineer, assistant to the works engineer, maintenance superintendent, and area engineer of the central repair shops. At that time the coordinator appears with the candidate to present a personal history card which outlines educational preparation, work experience, service experience, medical report, and other pertinent data. Each candidate is informed of his relative standing in the tests, and is told final selection will be based on personal qualifications, experience, and general adaptability to the course of study desired.

Final selection rests with the works manager, after a review of the recommendation of the works engineer. Again, rejected candidates are informed as to the reasons, and every attempt is made to maintain satisfactory industrial relationships throughout.

By this careful screening procedure the incidence of unsuitable students is kept to a minimum. In a few cases, after 6- to 9-months' trial it became evident that the knowledge being absorbed in the mind somehow was not coming out at the fingertips in the form of mechanical aptitude.

The apprentice understands at the start that management reserves the right to terminate apprenticeship for these reasons, or if business conditions demand reduction, modification, or discontinuance of the program. In case of renewal or expansion of the program after layoff, apprentices with satisfactory records get first consideration.

8000 Hours of Training

The entire 4-year course involves at least 8000 hours of shop and theoretical training. On-the-job training (about 6800 hours) is achieved by having each student serve as an apprentice to a master craftsman and helper on actual maintenance and construction jobs. Periodic rotation among all craftsmen is practiced to assure broad experience. Technical training (about 1200 hours) is given in classes at the plant, taught by the county vocational instructor. Two or three sessions are held weekly, averaging three hours each. In addition, electrical laboratory practice is given electrical apprentices at a nearby high school.

Subjects spread over the 4 years for all apprentices include mechanical drafting, blueprint reading and shop sketching, applied mathematics (arithmetic, algebra, geometry, trigonometry), shop science (discussions), metallurgy, applied mechanics, strength of materials, industrial economics and civics, and safety lectures. Also *every* apprentice, regardless of craft, studies electricity in the first year. Safety considerations motivate this requirement, because of the necessity for static-free operations in many parts of the plant.

A definite schedule, laid out by the maintenance superintendent, controls the shop and study activities of each apprentice. The course is fully approved by the State Department of Public Instruction and accredited under the provisions of the G.I. Bill. Therefore, careful records are kept of attendance and progress in both studies and shop work. A monthly report from the vocational instructor grades each man's studies and attitude.

The company believes that good industrial relations are important here as well. At the start, each apprentice is welcomed by the plant manager, and a 2-hour orientation follows. During the course the training coordinator briefs the men on company policies and industrial relations plans. Later, visual methods are used to explain organizational set-ups and to explain the mysteries of maintenance costs. If a large construction or maintenance project arises, *all* apprentices may be temporarily assigned to work there. Plant tours and lectures are designed to acquaint the men with operating functions, products, and accident hazards. Meetings are held to discuss general problems. All these things are done to develop an objective "plant interest," so that the men will be alert to do an intelligent job of maintenance.

Pay for Classroom Time

Apprentices are paid on an hourly basis, for time worked and time spent in the classroom, beginning at one dollar per hour, with rate increases every three months. The achievement rate upon graduation is the starting rate for journeymen. These rates are subject to adjustment up or down to conform with changes in prevailing rates for skilled craftsmen.

Textbooks, stationery, and other supplies are paid for by the company, also traveling expenses to the school. At the start each apprentice is lent a complete kit of the tools necessary to his chosen craft. Upon satisfactory completion of the course the tools are given to the graduate; otherwise they must be returned.

The company wants the graduate to realize the importance of his achievement. He receives two diplomas, one from the vocational school and one from the company, certifying his qualifications as a journeyman mechanic. The photograph of every graduate with his diploma appears in the plant paper.

Management believes it is getting out of the effort not only skilled maintenance mechanics, but good Du Ponters who will always have the company interests at heart.

PLANT PAINTING SCHEDULE
(Based on repainting all buildings inside and out every three years)

Building	Estimated Cost		Last Painted		Yearly Quarter to Paint		Paint in 1949		Paint in 1950		Paint in 1951	
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Warehouse Building	$2260	$625	1945	1948	3	2					1/ 2260	625
Machine Shop	4578	945	1943	1947	3	2	1/ 4578			945		
Forge Building	900	300	1943	1948	1	4	1/ ✓ 900					300
Power House Building	622	130	1945	1947	1	4			1/ 622	130		
Shop Office Building	2060	1150	1947	1945	3	4	1/ 2060	✓ 1150				
Cafeteria Building	300	300	1947	1947	2	3	1/ 300					300
Fence		285		1947		3				2/ 285		
TOTAL	$32,660	$10,595					$10,263	$4,075	$11,105	$3,150	$11,292	$3,370
COMBINED TOTALS	$43,255						$14,338		$14,255		$14,662	

Notes: ✓ —work accomplished
1/ —may be deferred in lean years 2/ —in good years, paint every year

Low-cost preventive maintenance guaranteed by

A Three-Year Painting Schedule

PHILIP GIFFORD • SUPERINTENDENT OF MAINTENANCE
THEW SHOVEL COMPANY, LORAIN, OHIO

A REPAINTING SCHEDULE, based on painting all buildings inside and out every three years, has recently been put into effect at the Lorain plant of the Thew Shovel Company. The purpose of this schedule is threefold:

1. It assures management that all structures requiring painting will be painted within this reasonable period.

2. It lets management know the approximate total cost of painting over a projected three-year period, thereby assisting in the budgeting procedure.

3. By careful planning, the work is scheduled by three-month periods over the ensuing twelve quarters. Thus, management is guaranteed that it will not suddenly be confronted with a year's painting bill all at once.

An abbreviated schedule sheet is illustrated above. Actually the sheet provides for 27 items and has the yearly columns extended through two full cycles to 1955. Inside painting of walls, ceilings, and structural members of production buildings (exclusive of washrooms, first aid rooms, and plant offices) is scheduled during the one-week vacation period in July.

The cost estimates shown on the schedule for the years 1949 through 1951 are based on the actual cost of the previous job, with allowances made for any increases in the cost of materials and labor. As the contracted cost of each of these jobs (for 1949) is determined, this figure is entered as a tentative estimate for the same job three years hence (1952).

Since bids are requested 30 to 60 days in advance of letting the contracts, the total bids for any particular quarter can be quickly compared with the original approved estimates before any contracts are signed and money is spent. If the cost is in excess of the estimate, the situation can be taken up with top management, and any necessary changes or adjustments made. The percentage by which the actual cost for each quarter varies from the estimate indicates how costs for the rest of the schedule will adhere to estimates.

Why Unions Cry "Speed-Up"—and

1 **EMOTIONAL.** The word speed-up is loaded with unpleasant emotional associations. This makes it an attractive rallying point for opportunists

2 **ECONOMICS.** Current business trends are forcing management to bear down on production costs. Labor's contribution must be increased productivity. This will be labeled "speed-up" by many unions

3 **IDEOLOGY.** The Commies like anything they can call speed-up because it is a good trouble-making issue

4 **POLITICS.** Witch hunts for issues near union election and bargaining times are part of internal union politics. Economic conditions plus left-wing noise increase the chances that speed-up will be grabbed as one of the more promising issues this year

M. J. MURPHY • ASSOCIATE EDITOR, FACTORY

THE NOISE THAT SOME UNIONS are making about speed-up is loud. It is likely to get louder in months to come, and more unions will get on the bandwagon.

There are four basic factors—emotional, economic, ideological, political—that point in this direction.

Emotional Factors

Speed-up is easily built into a headline issue because the word, through a long history of unfavorable usage by unions, has become highly provocative. The implication is that management is driving its employees, making them work too hard. And, like most words that are deliberately used to get a purely emotional response, it fails completely to indicate the actual issues at stake.

This is what gives the word its peculiar value as a device to rally employee opinion against management. If the issues themselves were clearly labeled in each case, widespread excitement over most so-called speed-ups would be rare.

The word has another advantage which makes it a "natural" for some unions. It is so general in its emotional appeal that it can be tied in with many other issues. For example, employee health and safety were linked with speed-up in the recent Ford strike. In the Singer Manufacturing Company strike the tie-in was with job security. The argument was that the company's incentive plan ("speed-up system") was leading the employees to work themselves out of jobs. In spite of its economic unsoundness, this argument was apparently believed by many workers.

Unions also find speed-up a useful weapon where their aim is to move in on management's right to control scheduling of production and setting of standards. Success in limiting an employer's authority over such key functions gives union officials greatly increased power and prestige. Furthermore, invasion of other traditional areas of management control is made easier once the first wedge has been driven.

To move in on management rights, a union must have strong employee backing. The trouble is that workers rarely get stirred up about such an abstract issue. Something has to be added to bring the problem closer to home and to arouse violent enough reactions to prove the union means business. Here is where speed-up comes into the picture. Properly dressed up,

How Management Can Answer

1 **TELL** the "economic facts of life" to management, employees, union officials, and the public

2 **STAND READY** and willing at all times to demonstrate that standards of performance are right

3 **TREAT** every grievance about production standards and output as a serious problem requiring *fast* solution

4 **ASSIGN** employees and schedule production realistically to avoid overmanning the work force

5 **HANDLE** disputes over production standards with skill and good sense; be willing to let the union save face

6 **NEGOTIATE** a sound labor agreement that will prevent disputes without sacrificing management's right to manage

the question becomes whether or not management "should have the right to change standards or start a speed-up any time it wants." Now the issue is real and exciting. The union needs only to develop it skillfully as its strategy requires.

Economic Factors

Productivity vs. Speed-Up. The biggest economic problem facing American industry today is to reduce production costs. Among other things, this means that management must regularly get a fair day's work from its employees for a fair day's pay. Output by the worker must increase in many cases, and poor producers must be replaced. Fundamentally this has little or no relationship to speed-up. But there are many who don't or won't understand this point. Where the union involved makes no effort to appreciate the basic economic distinction and shouts "speed-up" at every effort to improve productivity, there is almost certain trouble ahead.

To understand the present situation, a little background is necessary. During the war there was a big influx of inexperienced workers. They received their training and did their work under abnormal conditions. Wartime production pressure far outweighed the important peacetime factors of high productivity and low costs. The solution of all too many production problems had to be *more* manpower rather than *better* manpower. This was aggravated by demands of the Armed Services for military personnel. The result was a severe labor shortage that forced retention of all but the worst producers.

After the war, a period of unprecedented peacetime production began. The labor shortage remained serious. Enormous demand for consumer goods encouraged continuation of the "production at any cost" philosophy that had grown up during the war. Meanwhile, labor and material costs were going up.

Today, however, conditions are rapidly changing and the peak of inflation has been passed. There are few scarcities now. Buyer resistance is steadily mounting. Consumers must be *sold*. Production at any cost is a thing of the past.

Such conditions require many readjustments, spreading over every phase of manufacturing. They necessarily include readjustments in the attitudes and work habits of employees, many of whom have never worked under normal peacetime conditions.

What this all adds up to is that a great many em-

CARD DEALING STUNT was used by left-wing United Electrical Workers in Singer strike to emotionalize speed-up charges. Stunt tied in with method used by consultant who installed incentive plan to teach time study speed rating. Card tables were set up on street corners in attempt to arouse public resentment. Technique was designed to excite quick negative reaction without going into merits of issues

★

ployees are going to have to produce more per hour, per day, and per week. And it is right here that organized labor faces one of the greatest tests of its integrity and maturity. Unions that immediately shout, "That's speed-up," will have failed this test at the outset. The fact is, the technological improvements that have been made over the past decade enable workers to produce more with *less effort and greater comfort* than ever before. What has happened in countless cases of improved productivity over many years is just the opposite of speed-up so far as the individual worker is concerned.

What management wants and needs more than anything else from unions and workers is simply openmindedness to this fact—*that more units per hour do not automatically mean speed-up.*

Union Economic Philosophy. Many unions are strong advocates of the "lump of work" theory of production. This means that there is only a fixed amount of work to be done and that greater productivity merely exhausts the available supply and takes away jobs. Although wrong in the broad economic sense, the argument is often borne out in the case of small groups of workers in individual plants. For this reason, such thinking has a powerful appeal.

There are two ways in which it finds active expression:

1. Informal slowdowns, or restriction of output.

2. Formal restrictions of output, often spelled out in union bylaws in the form of featherbedding or other restrictive practices.

Most of the informal slowdown practices are current among locals of the big industrial unions; most of the formal restrictions occur in the craft unions. The crafts at least are honest about stating their intentions. But the industrial unions, although they almost always officially decry such practices, do little to discourage them. Too often, indeed, they give them their support by actively defending workers disciplined or discharged for taking part in slowdowns.

There is plenty of dynamite in this situation. Far too many employers have had to put up with slowdowns in industry during the past several years. The condition is unhealthy and has generated much bitterness in the firms affected.

One thing is certain about the slowdown problem, and the philosophy underlying it: *Management efforts even now to do something about it will undoubtedly be tagged with that good old label—speed-up.* It is almost equally certain that the unions which fight the hardest and denounce the loudest will be those that have been the worst offenders. This same "guilty conscience" reaction will probably also come from those workers who have been the most enthusiastic slowdowners.

Wage Trends. Current wage trends will lead to some increase in the noise over speed-up during coming months. So far, the "fourth round" of wage increases and fringe concessions has not been much of a success. This has surprised no one. The first three rounds skimmed off the cream, and the present economic picture does not justify further big concessions.

Bargaining is therefore going to be harder for many unions than it has been for years. More issues of the type that will arouse rank-and-file sentiment and support will be needed. That is why pensions and other welfare issues are being talked about so much by labor leaders. It is also the reason why speed-up, seniority, and other strong nonmonetary issues will be brought into action where expedient. This, of course, is nothing new or earth-shaking. It is regular union practice, but it is more necessary now than it has been for some time past.

Ideological Factors

Communists have always been fond of speed-up as an issue. They value it as a good tool for creating dissension and strife in labor-management relations. During the past several months they have been shouting "speed-up" from the house-tops in their official newspaper, the *Daily Worker.* Here is a typical example of the official party-line position:

"The Ford strike is not a dispute over something that suddenly began to bother the workers. It is the curtain-raiser of the revolt against speed-up that is bound to spread throughout industry. The force for this explosion has been accumulating since the days postwar conversion was completed and assembly lines began to develop speed."

Left-wing unions follow the party line. Moreover,

the noisy, Communist-led or inspired minorities in some right-wing unions follow along, too. It is a sure thing that the more the *Daily Worker* sounds off about speed-up, the more the Communists in labor will strive to stir up trouble over the issue.

The Singer Strike. The strike called by the left-wing United Electrical Workers (CIO) at the Elizabethport, N. J., plant of Singer Manufacturing Company is an illuminating example of how small an excuse such unions need for a strike once the party-line position has been announced.

The major issue was the company's incentive system. Union leaders wanted management to stop extending the plan to additional jobs and permit workers currently covered to withdraw. The reason for this demand: "The plan is a speed-up device."

Key point in the dispute is that the whole incentive system was put in by the company in 1946 *at the request of the union.* Based on time study standards, the plan gave the workers substantial additional take-home pay. It was popular and was supported by the union in three successive annual collective bargaining sessions. Moreover, in December, 1948, the union's business agent wrote:

"Our contract is second to none. We have better conditions, rates, seniority, and vacations than in similar shops throughout the country."

Only a few months later (early May), the strike was called. The contract was the same, and there had been no changes in management attitudes or policies.

It would be almost impossible to find a flimsier excuse for a strike over speed-up. Yet the strike was prosecuted with the greatest of vigor and virulence. More of this will be happening as this union and others like it follow through on the official Communist position. Where this happens, the Singer Company's example is the only sound one: stand firm against trumped-up party-line issues.

Political Factors

Labor unions are political organizations. Individuals and groups striving for power and prestige in unions are therefore always on the lookout for issues that can be exploited effectively. Sensitiveness to such issues is usually most noticeable just before elections of officers and delegates to conventions. Employers often see the results in the form of more grievances than usual and more aggressive follow-up of grievance cases. The same condition sometimes develops just before collective bargaining begins. Here the aim is usually to set the stage for certain demands.

In both situations, speed-up is one of the issues that may be singled out for special attention. It is an old favorite of dissident minorities because it has enough emotional appeal to cause embarrassment if it catches on. Right now, because of the left-wing campaign on speed-up, conditions are more favorable than usual for its use as a political tool.

The Ford strike in May over alleged speed-up in two final assembly departments is a good example of how politics may cause management no end of trouble. Here the political maneuvering was between the leadership of the giant Ford local and the international officers of the United Automobile Workers (CIO). From the beginning, Walter Reuther, international president, showed no enthusiasm for a strike over speed-up charges. The local president, Thomas Thompson, was apparently determined to have the strike. He won. The strike was called and lasted more than three weeks. The international union was forced not only to sanction the strike but also to give it active support.

Close observers of the automotive union picture now look for Thompson's next move at the union's convention where he will be able to judge the prestige value of his display of strength and aggressiveness. If reactions are favorable enough, he may be a candidate for Reuther's presidential job.

WHAT MANAGEMENT CAN DO

When complaints about speed-up reach major proportions, management is in a tough spot. But it is not defenseless by any means, either before or after the fact. The basic responsibility is to prevent such situations. If this is not possible, the obligation is then to take whatever corrective action is needed.

Preventive measures involve good organization, good policies, and good labor relations, built up as part of everyday operating procedure. If effective, there should be need for only a minimum of corrective action, and that should be largely at the level of grievance handling.

As a guide to operating management, there are six ways to reduce the probability of speed-up trouble:

1. Tell the "economic facts of life" to management, employees, union officials, and the public. Make every effort to see that these groups understand the true meaning and importance of high productivity. This is *not* an old story even though it may have been often told before. An amazingly large number of workers and union officials still do not really understand it. Particular emphasis should be put on the critical distinction between increased productivity and speed-up.

Where standards need revision because of improvements in methods, materials, or equipment, give workers a full explanation of the changes and of their importance. And even where standards have been too low for so long that workers now regard them as sacred, the errors should be admitted and fully explained. Do this regardless of whether or not management intends to do anything about such conditions, to keep the economic record straight.

Increased productivity is the life blood of American free enterprise. Management cannot afford to sit back and hope that the reasons why this is true will filter through to its workers or to the public. Industry has the clear and continuing responsibility to bring the facts to those who most need to understand them. The emotional fire of speed-up charges can be effectively fought only with the factual fire of honest and clear economic analysis. If management does not "fight fire with fire" in this way, the warped thinking of the

sincerely uninformed as well as the left-wing party-liners will have a clear field.

2. Stand ready and willing at all times to demonstrate that standards of performance are right. This is more easily said than done. But the mere fact that an employer is *willing* to subject his production standards to factual analysis is valuable. It is a demonstration of palpable good faith that cannot help having a good effect on employee atitudes.

It does not mean, however, that joint union-management setting of standards is to be recommended. Actually, there are few conditions under which such plans operate effectively. The old saw that a ship cannot sail under two captains applies with particular force in this case.

3. Treat every grievance or complaint about production standards or output as a serious problem requiring fast solution. It is hard to tell at the start whether an apparently routine grievance may turn into a big rallying point for speed-up charges. Most important of all, such problems should be handled *fast*. Nothing is more likely to lead to talk about speed-up than letting grievances pile up.

4. Assign employees and schedule production realistically to avoid overmanning the work force. Failure to do so complicates and confuses the productivity picture by unbalancing production. When poor production control and overmanning last for long periods of time, employees become accustomed to light work loads and rebel when the time comes to resume their former pace.

Furthermore, when incentive systems are operating, unbalanced and poorly controlled operations lead to employee dissatisfaction over reduced incentive opportunity. In itself, this does not contribute directly to speed-up complaints. But it does tend to generate suspicion and irritation among workers. This, in turn, makes it easier for troublemakers to create dissension over issues like speed-up.

5. Handle disputes over production standards with skill and good sense; be willing to let the union save face. Here, understanding of the basically political nature of organized labor is a help. Face-savers do not have to be damaging concessions or compromises. Often they amount to no more than phrasing a notice of settlement of the dispute so that it does not rub union officials the wrong way or make them look silly in the eyes of their constituents. Or saving face may involve easing up of disciplinary action taken against an employee, with the understanding that standards will be met in the future.

There are many ways in which good negotiating technique can pay off in productivity arguments without changing the basic decision reached by management. Where an employer is alert to them, there is less chance that hung-up grievances will hit the headlines.

6. Negotiate a sound labor agreement that will prevent disputes without sacrificing management's right to manage. This means that provisions relating to production standards should be exactly that and no more. There is no place in these clauses for disguised extensions of the rights-of-management issue, wherein the union succeeds in winning the limitations on management that it could not get elsewhere.

Avoid joint setting of standards. It leads only to trouble in most cases. On the other hand, fairness and good sense demand the inclusion of practical provisions for speedy review of standards as part of the grievance procedure. Such review should certainly provide local (in preference to international) representatives with all the facts.

If standards are to go to arbitration, careful provision should be made for the selection of competent arbitrators who will be able to render just and proper decisions. Permissive arbitration (that is, arbitration only by mutual consent) should, in general, be avoided. It usually just adds another issue over which to argue at a time when the parties are already deadlocked.

Finally, a sound and inclusive "no strike—no slowdown" clause should be sought as a preventive measure. Such clauses usually can be applied to production standards only where management is willing to make the issue arbitrable.

* * *

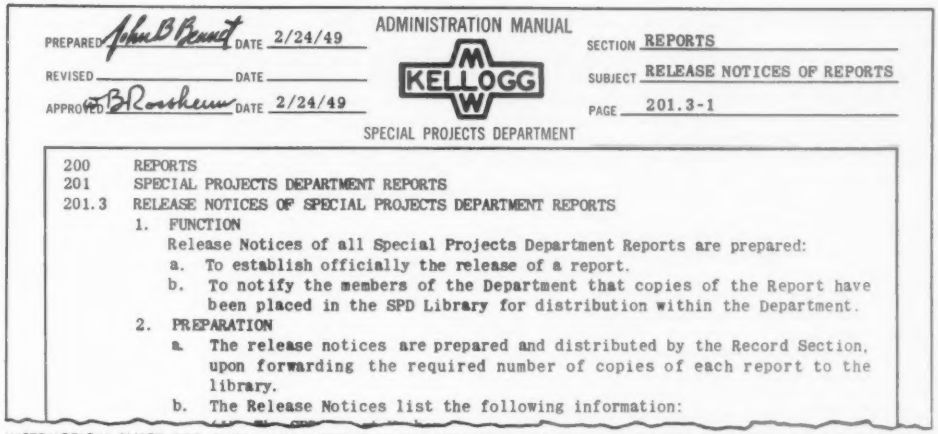
In the final analysis, neither labor nor management is going to settle speed-up arguments. Their real boss—the consumer—will call the shots. He ultimately buys the finished products of industry and he is going to keep on buying less and less of them if he is not satisfied with the price that he has to pay.

As the man who pays the bills for both management and labor, Mr. Consumer isn't interested in speed-up or economics or ideologies. He doesn't give a hoot about *why* prices remain high. He just wants prices to come down. If they don't come down, the bills won't get paid.

If management doesn't get paid, neither does labor. Both must prosper, or starve.

There is a simple moral to this little economic tale:

Management alone cannot increase output and decrease costs, nor can labor alone. But *together* they can. More hue and cry about "together" and less about "speed-up" is what the consumer—the boss—wants to hear.



PREPARED John B Bennet DATE 2/24/49
REVISED _____ DATE _____
APPROVED B Rosheim DATE 2/24/49

ADMINISTRATION MANUAL
M KELLOGG W
SPECIAL PROJECTS DEPARTMENT

SECTION REPORTS
SUBJECT RELEASE NOTICES OF REPORTS
PAGE 201.3-1

200 REPORTS
201 SPECIAL PROJECTS DEPARTMENT REPORTS
201.3 RELEASE NOTICES OF SPECIAL PROJECTS DEPARTMENT REPORTS

1. FUNCTION
Release Notices of all Special Projects Department Reports are prepared:
a. To establish officially the release of a report.
b. To notify the members of the Department that copies of the Report have been placed in the SPD Library for distribution within the Department.

2. PREPARATION
a. The release notices are prepared and distributed by the Record Section, upon forwarding the required number of copies of each report to the library.
b. The Release Notices list the following information:

INSTRUCTION SHEET FOR EACH ADMINISTRATIVE PROCEDURE TELLS PERSONNEL WHAT'S INVOLVED AND HOW TO DO IT

Procedure Manual Reduces Errors

JOHN B. BENNET • RECORDS SECTION ENGINEER, SPECIAL PROJECTS DEPARTMENT, THE M. W. KELLOGG COMPANY, JERSEY CITY, N. J.

PREPARATION OF A MANUAL on administrative procedures in the special projects department of the M. W. Kellogg Company is paying for itself many times over in improved worker efficiency. Because it gives some 230 technical employees of this department all the rules and regulations controlling their work activities, much wasted time spent in asking questions on procedures or in correcting action begun in error has been eliminated.

The need for such a manual became obvious early in the life of this department four years ago. Despite the fact that a large majority of the personnel are intelligent college graduates, their ignorance of correct administrative procedures led to needless confusion, lost motion, and misunderstanding. Also, it was impossible to brief each new employee in the administrative ramifications he might encounter. During the course of a day's work many questions would arise, such as "How do I order this blueprint?" "How are my travleing expenses handled?" "Where can I get available data on this subject?" or, "Who can authorize this action?"

The administrative manual was designed to answer quickly all such pertinent questions. Secondly, it had to be flexible in content to allow expansion, correction, or superseding changes. This second requirement was met by adopting a loose-leaf method of binding all pages, and numbering them by a simplified Dewey decimal system whereby pages could be added or taken out without disturbing the existing order.

Meeting the demand for easy reference, however, was not so simple. The special projects department encompasses many diversified activities. It studies and issues reports on technical problems in physics, chemistry, electronics, instrumentation, and so forth. It handles design work, experimental fabrication and associated purchasing, and provision of test facilities for its own diversified items of manufacture.

Despite this handicap of prescribing specific procedures for innumerable activities, an easy-reference manual was achieved by developing it according to the following important principles:

1. Organization of the manual

a. Wherever possible, the manual was built around the printed forms (requisitions, engineering orders, purchase orders, time tickets, etc.), which are the tools of administrative procedure. This method was not applicable or even necessary for such functions as files, mail service, and similar services.

b. Separate instruction sheets of one or more pages were issued for each departmental routine. Related sheets were combined in one section, covering a general activity or function.

c. Sections were prepared to cover all major activities of the department and listed in a table of contents for easy reference. Subheads and specific subjects in the table narrowed down the index so anyone could quickly find whatever was wanted. To facilitate easy reference, an alphabetical index according to subject title was later added as a separate section.

Typical of the major functions covered by sections are simple heads like personnel, reports, patents and publications, files, ordering, drawings, timekeeping, safety, correspondence, and services. The section on services is subdivided, for example, into subheads like library,

keys, telephone, motor vehicles, and the like.

2. Organization of the instruction sheet.

Key to the easy readibility of the manual was the adherence to a consistent method of preparation of each sheet, to make things easy to find. Also, a standard format of the sheet was adopted, as illustrated, to accurately identify each sheet as to function, location, authorization, and date of issue.

Every instruction sheet follows more or less this order of presentation of material:

a. Statement, under "Function," of the procedure and explanation of its significance to departmental operation.

b. Description, under "Preparation," of the printed form to be used, and instructions how to execute it.

c. Instructions, under "Initiation and Approvals," for starting action and getting all necessary approvals.

d. Descriptions, under "Routing and Filing," of the flow of paperwork.

e. Definition, under "Responsibilities," of the authority established for carrying out the procedure.

3. Preparation of the instruction sheet

Brevity and conciseness, consistent terminology, and clarity were sought in drafting each sheet. To assure the assembly of complete and accurate information all personnel concerned with a procedure were interviewed. Elaborate cross-checking helped eliminate any inconsistencies and contradictions.

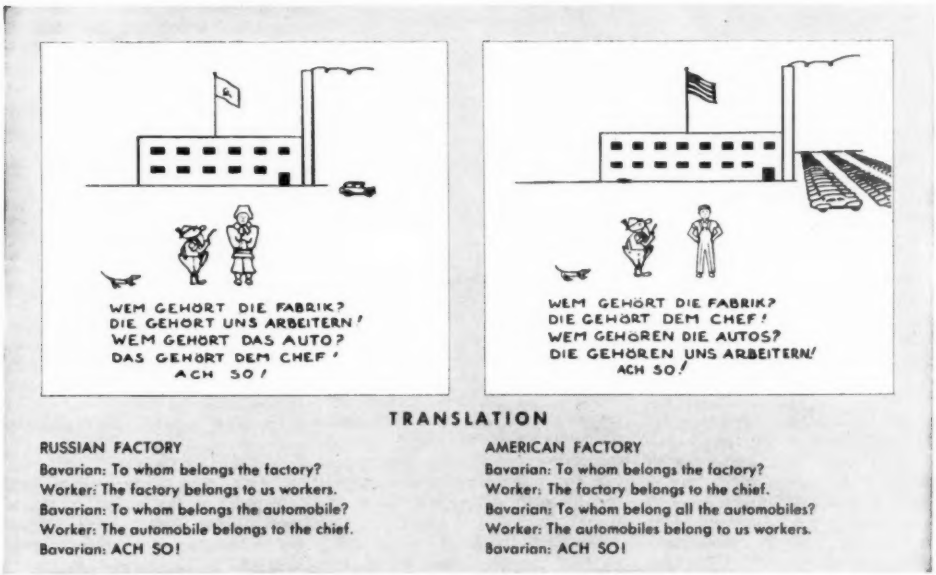
By adhering to an outline form, with short sentences and liberal paragraphing, the sheet lent itself effectively for use as a quick checksheet to guide the application of the procedure.

Actual preparation of the administrative manual containing some 225 pages, involved about 120 man-hours of work in drafting the text and about $100 for paper and printing costs. To keep the manual up to date requires only a few man-hours a month.

Distribution of about 30 copies includes division and section leaders and some staff personnel. Extra copies are available in the departmental library for indoctrination of new employees, and for ready reference by all personnel.

The value of the manual is evident by its general acceptance as an authority on administrative procedures. In consequence, needless misunderstandings and friction have been replaced by a knowledge of well defined responsibilities. Procedures have been clarified, and every man knows not only how far he *can* go but also how far he *should* go, to do his job right.

A German View of Two Economic Systems



TRANSLATION

RUSSIAN FACTORY

Bavarian: To whom belongs the factory?
Worker: The factory belongs to us workers.
Bavarian: To whom belongs the automobile?
Worker: The automobile belongs to the chief.
Bavarian: ACH SO!

AMERICAN FACTORY

Bavarian: To whom belongs the factory?
Worker: The factory belongs to the chief.
Bavarian: To whom belong all the automobiles?
Worker: The automobiles belong to us workers.
Bavarian: ACH SO!

FOR THE CARTOON and translation, FACTORY is indebted to David J. Winton of the Winton Lumber Sales Company, Minneapolis. He reports it was obtained by Lyle Munson, Central Intelligence, U. S. Department of State, from a German newspaper editor, who credits it to a thirteen-year-old Bavarian boy.

At Munson's expense, thousands of copies were dropped by the airlift in the Russian zone.

LOOKING AHEAD IN LABOR

Last-minute round-up as we go to press

Will Congress keep the spirit of Taft-Hartley?

You'll get your answer in what happens on these still controversial issues:

—National emergency strike injunctions.

—Injunctions against unfair labor practices like secondary boycotts and jurisdictional strikes.

—Closed shop ban.

—Restraint against union coercion of employees.

—Union responsibility for observing contracts.

—Exemption of foremen from the right to bargain.

Taft-Hartley backers on Capitol Hill will measure their success by how much of that list sticks in the bill that goes to Truman's desk. If there's too much, Truman might veto again.

Right now, word from the White House is that Truman will sign the best bill the Democrats can put over. Just so it repeals Taft-Hartley—in name.

Democratic concessions, put over by Douglas of Illinois, admittedly were in the "spirit of the Wagner Act." They didn't impress the Taft-led forces who were seeking reasonable improvements in the Taft-Hartley law but keeping the guts of it.

Two amendments, for instance, simply permit free speech by employers (as well as union leaders) and require unions, like employers, to bargain.

Two others extend the non-Communist (and non-Fascist) affidavit rule and the filing of financial reports to include employers.

Plant seizure, without injunction, would hit at employers but not unions in national emergency strikes.

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In the states, labor leaders haven't been successful in killing anti-closed shop laws this year. That's why they argue for a federal law restoring the closed shop and taking precedence over state laws.

They won't get such a law. Too many key legislators whose votes will swing the new law one way or the other come from states which ban or regulate the closed shop.

Fact is, labor's record with state legislators has not been good since last November's labor "victory."

In 1948, Louisiana repealed restrictive labor laws after Gov. Long took office. Efforts to ban the closed shop in Maine, Massachusetts, and New Mexico were repulsed at the polls. Only North Dakota and Arizona took closed shop steps against unions.

This year is different. Bills to restore the closed shop failed in four states: Georgia, Iowa, North Carolina, Tennessee.

Thus, closed shop contracts are still illegal in those states and Arizona, Arkansas, Florida, Nebraska, North Dakota, South Dakota, Texas, Virginia.

In Colorado, Kansas, and Wisconsin, workers must approve any contracts which force them to join unions. In Delaware and Maryland, union security pacts are against public policy but there's no enforcement of the laws.

Organized labor's one real victory this year occurred in New Hampshire. The 1947 Willey Act requiring union security elections was repealed.

Even in two industrial states, where anti-utility strike laws were declared unconstitutional, labor leaders were unable to kill the laws. Instead, laws were amended.

Michigan revised the Bonine-Tripp Act to provide for fact-finding and voluntary arbitration. Also, a majority of voting employees must approve a strike.

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New developments on picketing: NLRB holds that picket violence directed at an employer can be construed as illegal coercion of employees. The CIO wants the Supreme Court to nullify an Idaho law against picketing in a secondary boycott.

This is the month Northern coal operators, U. S. Steel, or Ford decide what wages many other employers will pay out over the next year.

Despite rising unemployment and worsening business conditions, management won't be able to get off the hook this year without some concessions. For most, added labor costs will run between 5 and 10 cents an hour.

Business downslide will bring some "spread the work" slow-downs. Unions will be trigger-quick to strike against employer efforts to trim costs by cutting crews and increasing workloads. Stock excuse: *"Speed-up."*

Labor Youth League—That's the name of a new Communist front organized last month at Chicago. An organizing drive is under way.

Political notebook—Labor leaders are without a top-flight candidate to pit against Taft next year. (Gov. Lausche won't run.) Main labor targets will be Taft and Sen. Donnell of Missouri. Other unions will follow the Garment Workers in setting up a system of political shop stewards.

LOOKING AHEAD IN BUSINESS

Last-minute round-up as we go to press

Customers have plenty of purchasing power. As a whole, they plan this year to buy more automobiles, more television sets, about as many homes, and almost as large a volume of other durable goods as in 1948.

These conclusions of the Federal Reserve Board's 1949 survey of consumer finances come from one of the most cheering reports business has seen this year:

1. *Slightly more than half of all families had higher incomes in 1948 than in 1947.* Apparently most of the advantage of higher incomes went to families with incomes of less than $4,000 — substantially broadening markets for business.

2. *Nearly half of all consumer units (people living in the same dwelling, related, and who pool their incomes to meet major expenses) had incomes of more than $3,000.* More than 3.5 million families moved up into the $3,000-and-above income bracket during 1948.

3. *At least as many families had some liquid assets—Government bonds or bank accounts—in 1948 as in 1947.* The Board's surveys over the last three years show that the great majority of families have held on to savings in spite of inflation.

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The Board found that consumers last year bought 3.1 million new cars and 5.6 million used cars. In all, they bought 2.4 million homes—800,000 of them new.

In 1949, survey estimates show, between 3.6 million and 5.1 million families have some intention of buying new cars. This is more than planned to buy last year—and more than actually bought cars last year.

Intentions to buy houses were about as strong this year as last—but more customers are interested in new homes this year. Well over one million families are estimated to be planning to buy new homes.

Families had plans to buy fewer refrigerators, washing machines, and other selected durable goods than they bought last year—but the Board found evidence of strong underlying demand that might make itself felt if products and prices were attractive.

The survey highlights one conclusion highly important to business: The market is there and can be tapped if business goes after it aggressively with attractive merchandise at attractive prices.

The survey was made in January and February. Since then incomes have slipped off slightly and jobs are harder to get. Does that out-date the survey's findings? The evidence suggests that it may affect them —but probably only slightly. Recession scares in 1947 and 1948 apparently did not affect the plans reported to the Board early in those years. Customers as a whole went right ahead and bought as much—or more—than they had planned to. Beyond that, the relative strength of consumer finances—plus the fact that incomes are still high, still running ahead of last year—is good evidence of purchasing power.

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Economists and business observers split sharply on the business outlook today. They vary widely in estimating how far production will decline or recover, and how long the slide in production will last.

Here are insights into prospects for four key industries that will help you form your own ideas:

Textiles have seen production sagging—about one-fourth off last fall's peaks. A series of price cuts has not yet brought new orders in volume. But retail sales of apparel and textiles have held up—certainly are not down a quarter. That suggests new orders as retailers, middlemen, and the mills exhaust inventories. *Production should pick up this fall.*

Homebuilding is a strong prop under business. It is making itself felt only now. The number of houses started in May reached 95,000—only 5 per cent under 1948's record peak. *As those houses are finished, late in the summer and fall, sales of appliances, furniture, and other home products will get a steady lift.*

Capital goods—as reflected in production of machinery—are now about 15 per cent below their peaks of last fall. That is about in line with the reduction planned in industry's purchases of new plants and equipment. Both McGraw-Hill and Commerce Department surveys showed the possibility of a tapering off in capital investment. *But—unless investment plans change suddenly—capital goods promise to stabilize at about their level today.*

Steel production has dropped from 102 per cent of capacity to about 85 per cent, seems headed down further. Customers, drawing down inventories, have contributed to the decline. Where it levels off—or when it begins to rise—depends on level of general business, particularly on auto production. The survey of consumers' plans, and the fact that incomes are still running high suggests that hard selling has a good chance of curing. *So Steel's prospects depend on how well its customers do.*

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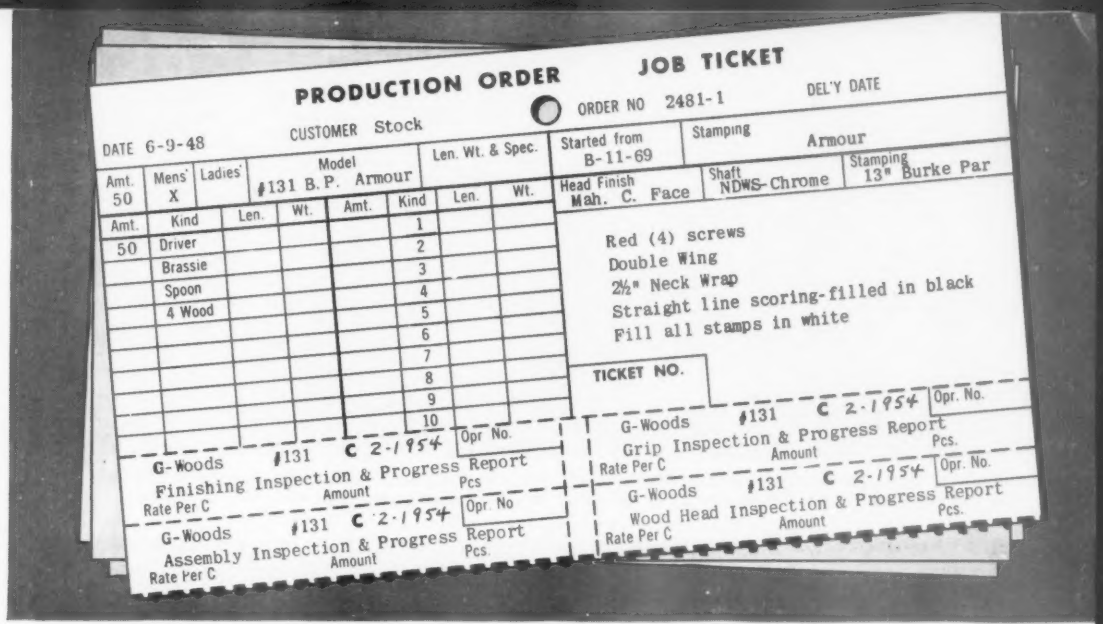
All in all, these things—the position of customers and prospects for these key industries — indicate there's a lot of strength in the business outlook.

The fall months—beginning in September—may well see today's slide arrested or even reversed.



INSPECTION AND PROGRESS TICKETS ATTACHED TO CARDS OF JOB TICKETS FOR EACH DEPARTMENT PROVIDE CONTROL

Job Tickets Control Complicated Production

PAUL HORGAN · PRODUCTION MANAGER
McGREGOR GOLF, INC., CINCINNATI

PRODUCTION CONTROL is a tough problem at the Cincinnati plant of McGregor Golf, Inc. Thousands of various types and sizes of golf clubs are in the heading, assembly, gripping, and finishing departments at the same time. A similar problem exists with tennis equipment. Yet it must be possible at all times to know exactly in which departments the various orders are being processed so that the promised shipping dates can be met.

Here is how it works. For a standard model on which a definite quantity is required monthly, orders for a month's production are released to the shop the fifteenth of the previous month. For each model and type of club (spoon, mashie, etc.), a plate has been prepared on which is recorded all of the information required for the entire shop operations. From this plate, a production order job ticket is printed. Each department has separate plates on which their piecework tickets are printed. The top of the ticket contains a complete description for manufacturing purposes of each club to be manufactured. Along with these production tickets there is an inspection ticket for each department. All of the department tickets are stapled together, with inspection on the top. Work moves to the various departments in the order of the relative position of the ticket to the top. Each head ticket bears a serial number, as does each operator's ticket. This serial number affords the office a double check between the ticket head and the operator's ticket.

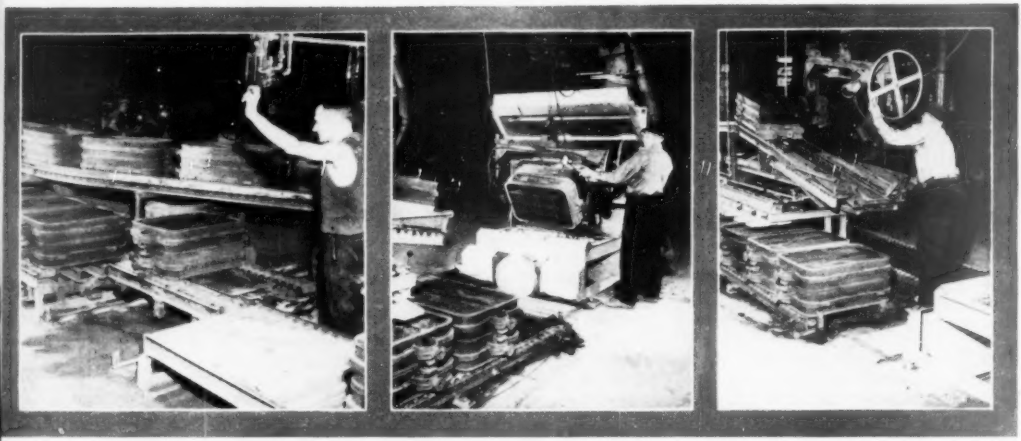
The entire production order, with job tickets attached, goes to the first operation. When the first production operation has been completed (in the wood department for the order illustrated), the production order is placed in the basket with the finished parts for the inspector. If the inspector approves the parts, he removes the "wood head inspection and progress report" ticket (lower right) from the production order. All of these tickets which he removes from the inspection portion of the production order are returned to the production department at the end of the day. Since each ticket indicates the number of pieces that have been inspected and approved, it is relatively simple for the production clerk to enter the number and production status of the order on the visible index.

Up-to-Date Production Report

This provides a constant running check of the stage of manufacturing of each order and permits accurate delivery estimates. For example, a pro might write in and want to know when he can expect his personal set of woods. We look up the sheet bearing the pro's name. If we have already received the "wood head" and the "assembly inspection" tickets, we know the clubs are somewhere in the gripping department. We can then call the foreman and ask him the shipping date for the clubs.

A different color production order is used for each type of item manufactured. All golf club orders were printed on blue coupons, golf ball orders on orange, tennis racquets on yellow, and personal-use clubs on green. This tells the payroll department what account number to charge for labor tickets turned in.

SPECIAL EXHAUST at molding station holds dust count at low level. Hinges at front of machine simplify inverting the drag as it is moved to form completed flask on pouring conveyor, shown at the right



TRANSVERSE SECTION from larger molding stations feeds parallel conveyors, prevents jams in moving flasks to knock-out. Pneumatic ram pushes empty flask up the incline for gravity return to the conveyor

Less Dust, Higher Productivity

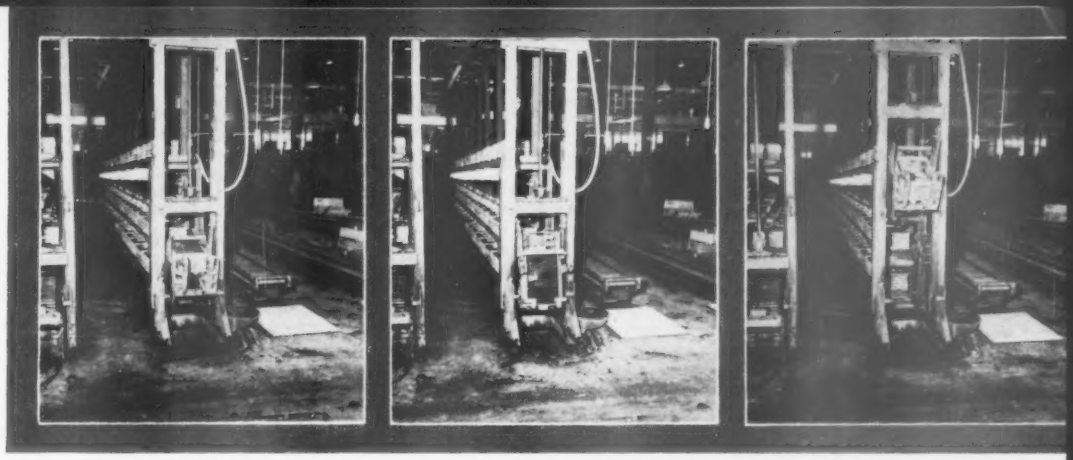
Better working conditions attract men who would not have considered foundry jobs before. Scheduled output per square foot is up a half over former peak

F. R. ELLIOT • FOUNDRY SUPERINTENDENT, WESTINGHOUSE ELECTRIC CORPORATION, EAST SPRINGFIELD, MASS.

HOW CLEAN AND HOW LIGHT can foundry work be? Certainly a lot cleaner and a lot lighter than in most foundries even today. We don't feel that the Westinghouse foundry at East Springfield has yet reached the ultimate possible goal on either score.

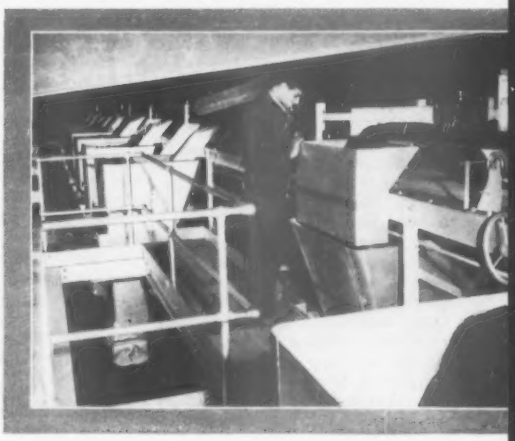
But we know—and can prove—that our $1,250,000 mechanization and modernization program has not only improved working conditions, but increased foundry productivity over a year and a half ago. The net result is that we can now attract the right type of employee by competing directly with nonfoundry operations.

Here are the figures that take such statements out of the realm of "claims" and put them in the class of solid facts:



AUTOMATIC KNOCK-OUT at terminal of pouring conveyor inverts flask, dumps hot sand and casting to oscillating conveyor below, and places empty flask on top level of conveyor for gravity return

OUTSIDE CONVEYOR carries hot castings from shake-out, cools them on way to segregation point



HOPPERS are fed from belt conveyors carrying sand from shake-out to mixers, then to molding machines

in a Modernized Foundry

1. **Dust count.** For the general foundry area, dust count formerly varied between 1 and 5 million particles per cubic foot; it is now a fairly uniform 1.5 million. (The Massachusetts Department of Labor and Industry recommends that the average exposure be held below 25 million.) At the shake-outs, the count formerly varied from 3 to 35 million particles per cubic foot; the new, specially exhausted, under-floor shake-outs are held to 1.7 million. Around the molding machines, the dust count has been cut away down to about 0.8 million.

2. **Handling.** Elimination of heavy manual handling was the main objective in modernizing the foundry. A careful survey of our operations revealed that some of our molders were handling manually as much as 90,000 pounds per day. Reductions up to 100 per cent have been made by the use of mechanical devices.

3. **Productivity.** Despite the lessening in the amount of physical effort on the part of employees, over-all output of the foundry has increased from 22 pounds of castings per month per square foot of floor area at the pre-war peak to a presently scheduled output of about 30 pounds per month per square foot. Approximately the same number of men are employed. By adding to the work force and operating an additional shift, the mechanized equipment now installed would make possible a capacity of more than 50 pounds per month per square foot.

Continued on next page

It is not too much of an exaggeration to say that the present modernization program goes back a full ten years to the time the present foundry was built. Although the details were not worked out, the original plans provided the flexibility necessary for just such a modernization program as the one carried out in 1947 and 1948.

Following the planning of the new layout on a three-dimensional scale model, the first step was the pouring of a new foundry floor and semi-basement. Principal feature of this construction was the network of under-floor tunnels that it produced. Knock-outs, rather than shake-outs, are located above these tunnels, so that hot castings and sand drop below the floor level onto oscillating conveyors. The conveyors carry the castings and sand to a single, specially exhausted, under-floor shake-out.

Castings from the shake-out are collected by a gate until a tray on the monorail conveyor passes below, then are dumped to the tray for an hour-long trip *outside* the building to cool.

Sand from the shake-out falls to a belt conveyor, which passes it over a powerful magnet to extract the tramp metal fragments.

In repeating its cycle, sand is carried on rubber belt conveyors from the mixers to the hoppers above the molding machines. Adjustable deflector arms are used as scrapers to divert the flow of sand from the main to the subsidiary conveyors and then to the hoppers.

Automatic Control

Two types of molding machines are used. With a single minor (but very important) modification on the smaller of the two, they differ little from conventional, up-to-date molding machines with hopper sand feed. The modification consists of a specially developed push-button control which automatically performs and regulates all of the mold-making operations. It removes all reliance upon skill and manual effort and permits the molder to perform other operations while the molding machine is in operation.

The molds produced on the smaller machine are of a size that does not justify using a hoist for moving the cope and drag to the pouring conveyor a few feet away. However, the necessity of inverting the completed drag in the course of moving it to the conveyor introduced an awkward and tiresome operation. This was overcome by placing two small spring hinges on either side of the front edge of the machine which engage the lower flange of the flask and permit it to be rolled over with very little effort. The operator merely pulls the completed drag forward a few inches until the hinges engage the flange; then he can flip the drag over, using the hinges as a swivel. The operation requires little skill or strength. The lightweight aluminum flasks used contribute materially to easing the job.

Once on the roller conveyor, the completed flask is pushed forward one flask length by a pneumatic ram. This has the effect of moving forward all flasks on the conveyor. The last one, at the discharge end of the line (which has long since been poured as it moved down the conveyor), is pushed onto a special "caged" section of the conveyor. This section operates automatically to invert the flask, knock out the sand and casting to the tunnel below, and then raise the empty flask to a higher-level conveyor for its trip back to the molding station. The process eliminates not only manual handling, but even the need for personal direction of equipment at the knock-out.

Larger castings are produced by pairs of molding machines working in tandem; one completes the drag, the other the cope. Air hoists are used for handling at the machines, and pneumatic and hydraulic rams keep the conveyor clear in the working area. Parallel conveyors, with a transverse section from one to the other, prevent jams if it is necessary to hold poured molds on a conveyor for cooling.

At the end of these conveyors, a hoist is used to pick up the flask, invert it over the knock-out, and place it on the return conveyor. Another pneumatic ram is used to push the empty flask up and over an inclined portion of the roller track from which it returns by gravity to the molder.

Atmosphere Control

Total air withdrawal from the foundry is 206,000 cfm., resulting in 8.4 complete changes of air every hour. Strategic placement of the major air circulating units, however, produces an over-all effect equivalent to a far greater turnover of general foundry air.

Three-bag-type dry dust collectors, totaling 33,000 cfm., provide special exhaust for such dust producers as tumblers, grinders, and sand blasters. Each is driven by a 40-hp. motor. Total collection is approximately 2430 pounds daily.

The sand system (shake-out, vibrating screens, mixers, and so forth) is exhausted by three wet-dust collectors, driven by two 40- and one 50-hp. motor. Total capacity is 60,000 cfm. The lighter dust is carried off with the waste water, while 1350 pounds of recoverable sludge is collected daily by a settling tank.

General foundry air circulation is accomplished by eighteen fan-driven roof ventilators totaling 113,000 cfm. Of the propeller type, these ventilators require a total of 10 hp. to operate.

The building is heated by sixteen unit heaters and ten forced-air curtain heaters. The unit heaters are located at strategic points. They can be used either to draw in and heat fresh outside air, or to recirculate the air in the building. The curtain heaters are located over doorways and conveyor exits to prevent incoming drafts of cold air when the doors are open. The curtain heaters recirculate inside air only. The heating system has a total capacity of 12,300,000 B.t.u., based on five-pound steam pressure. A total of 48 hp. is required to drive the various heating units. The heating system will maintain a 60-degree inside temperature with an outside temperature of zero and a fifteen-mile wind.

Top management authorized the expenditure for the modernization program on the basis of the improved working conditions that it would provide. The program has already met their expectations in every respect. It has also increased capacity and over-all productivity, and reduced manufacturing costs.

Every Month...

AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to **WHAT'S NEW IN EQUIPMENT** (page 148) ... a summary of **LABOR DEVELOPMENTS** (page 232)...things **YOU WANT TO KNOW** more about (page 224)

1

Penalties for Improper Adjustment of Gas Burning Equipment

	Correct Adjustment	Excess Gas Adjustment			Excess Air Adjustment		
		5%	10%	20%	20%	40%	60%
Annual fuel cost	$1800	$1890	$1980	$2160	$1827	$1860	$1897
Penalty for poor adjustment	None	90	180	360	27	60	97

How to Keep Gas-Fired Equipment in First-Class Condition

Only adherence to a definite inspection program will reveal what adjustments and repairs are needed to conserve fuel and guarantee safe operation

D. A. CAMPBELL · MANAGER, BRYANT INDUSTRIAL DIVISION
AFFILIATED GAS EQUIPMENT, INC., CLEVELAND

LACK OF PLANNED MAINTENANCE of its gas burning equipment is costing industry over a million dollars extra in monthly fuel consumption. This needless penalty is conservatively based on an average heating loss of 2 per cent in equipment that is poorly adjusted or improperly maintained.

Perhaps the significance of such unnecessary waste will strike home better by gaging its effect on the economics of operation of a single average-sized industrial unit. Take, for example, a paint or core drying oven, a glass lehr, a bake oven, or a hot water tank consuming 10 therms (one therm equals 100,000 B.t.u) per hour. Using an average cost of 7½ cents per therm, the fuel cost for any of these operations will run about $1800 per year. On this cost basis, Table 1 shows the penalties involved in operating gas burning equipment that is poorly adjusted.

In addition, other losses stem from: (1) lowered furnace temperature, which may have a decidedly undesirable effect on quality of the product; (2) reduction in the rate of units processed; (3) equipment shutdowns that are unnecessary.

Unlike other mechanical devices, gas burning equipment will continue to operate without breaking down, although at progressively lower efficiency, no matter how poor its condition may be. Hence maintenance of such equipment frequently is hit-or-miss, or entirely overlooked. Sometimes it degenerates into merely the repair of inoperative parts. Until that point is reached, valuable heat losses go unnoticed up the flue. Or else safety attachments won't work when they should, with consequences that are even more costly.

When and What to Inspect

Planned maintenance procedures involving periodic inspections of gas burning equipment are the only means for assuring economy and safety of operation.

The details of scheduled maintenance procedures vary according to: (1) the type or part of the equipment; (2) the nature of the service in terms of plant cleanliness and temperature of the air supply. The influence of these factors is shown in Table 2, which gives the suggested frequency of preventive inspections under various conditions for the basic types.

In the atmospheric type, the air for the fuel mixture is drawn from the atmosphere through an inspirator at or near the point of combustion, while the secondary air for combustion is supplied by natural draft through the unit being heated. In the blast type, air under pressure is used to form the fuel mixture and supply it to the unit. The atmospheric type is used more widely on low-temperature heating units such as baking or drying ovens. The blast type is more generally used for high-temperature units, such as annealing or billet pre-heating furnaces.

In addition to these two basic types, there is the "full premix" type, which can serve a large number of burner appliances requiring identically the same fuel mixture at all times. In the premix installation, which really is an outgrowth of the blast equipment, the gas and air are drawn through metering devices in proper combustible proportions and into a compressor that delivers the combustible mix-

2 Suggested Maintenance Schedule for Gas Burning Equipment Under Different Service Conditions

Type of Gas Burning Equipment	Parts of Equipment That Require Maintenance	Number of Table Giving Required Maintenance	A Cleaned Air and Controlled Temperature	B Partially Cleaned Air and Controlled Temperature	C Average Conditions, Air and Temperature	D Dusty Air, Wide Temperature Variations	E Lint or Fibers in Air, Variable Temperatures	F Oil or Soot in Air, Variable Temperatures
Atmospheric Equipment, High-or-Low-Pressure Gas	1. Mixers and venturi injectors	3	1*	2	4	6	12	12
	2 Burner heads or nozzles		1	2	4	6	12	12
	3. Pilot burners		3	6	6	12	24	12
	4. Pressure regulators		2	4	4	6	6	6
Blast Equipment	1. Blowers	4	2	3	4	12	12	12
	2. Air-gas mixers		1	2	3	4	6	6
	3. Burners, open		12	12	12	12	12	12
	4. Burners, closed		12	12	12	12	12	12
	5. Pressure regulators		2	3	4	6	6	6
	6. Zero governors		2	3	4	6	6	6
Control and Protective Equipment	1. Motor and solenoid valves	5	4	4	4	6	6	6
	2. Ignition devices		12	12	12	12	12	12
	3. Auto pilots		12	12	12	12	24	12
	4. Wiring connections		4	4	4	6	6	6
	5. Electronic equipment		12	12	12	12	12	12
	6. Gas cocks		12	12	12	12	12	12
Auxiliary Apparatus	1 Heat surfaces in appliances	6	2	3	4	6	12	12
	2. Secondary air openings		12	12	12	12	12	12
	3. Dampers		12	12	12	12	12	12
	4. Flue pipes		6	6	6	6	6	6
	5. Building flues		6	6	6	6	6	6

*Figures indicate the suggested number of inspections per year

ture under pressure to the distribution system serving the various burners.

Explosion Protection

To prevent the possibility of a serious explosion in the premix distribution lines, they are protected by back-fire checks or flame arresters. In some installations electrically operated shut-off valves are used that operate automatically should a fire occur in the supply lines.

Modern gas burning equipment is designed to operate at an accurately maintained air-gas ratio. Even a relatively small deposit of oily dirt will change the operating ratio. This *always* reduces efficiency and costs money. Hence proper maintenance of atmospheric or blast equipment and its auxiliary apparatus generally consists of keeping it clean.

The appearance of a yellow flame indicates improper flame adjustment. When such flames hit relatively cool surfaces the result is a deposit of soot, or carbon in solid form. Soot eventually plugs up flues and other parts of the apparatus, resulting in a further loss of draft and the possibility of production of deadly carbon monoxide. Deposits of soot can lower the efficiency of the unit by as much as 50 per cent.

Modern atmospheric gas appliances are designed for easy access for cleaning air passages, venturi tubes, burners, and flues, which permits sharp, clean flames to be maintained at all times. Cleaning of blast equipment is not so easy, however, because of the usual en-

3 **Required Maintenance for Atmospheric Equipment**

PART	MAINTENANCE REQUIRED
1. Mixers and venturi injectors	Brush or scrape clean inside. Readjust air-mixer shutter. Check orifice alignment.
2. Burner heads or nozzles	Clean thoroughly. Line up with firing opening. If burned or damaged, replace or repair to original condition.
3. Pilot burners	Clean and readjust to produce satisfactory flame properly located to light main burners. Tighten mounting brackets.
4. Pressure regulators	Using gage, check outlet pressure at various loads. If not reasonably constant, repair or replace. If sluggish, a few drops of neatsfoot oil may soften diaphragm. If regulator does not hold low loads, clean seat. Be sure breather hole is always open.

4 **Required Maintenance for Blast Equipment**

PART	MAINTENANCE REQUIRED
1. Blowers	Oil or grease motor or shaft bearings as and when required. Check for impeller slippage on shaft. Open case and clean thoroughly. Keep inlet guard clean. If filter is used, clean when required.
2. Air-gas mixers	Clean all air passages as required. Check air-gas ratio against change by vibration or tampering.
3. Open blast burners	Check for proper location in firing opening. If nozzle is burned or damaged, replace.
4. Buried blast burners	Check for tight joint with refractory. Check combustion tunnel for smoothness and correct shape. Replace nozzle or refractory if damaged or burned.
5. Pressure regulator	See Table III.
6. Zero governor	Same as for pressure regulator. It is much more sensitive. Should not be used as shut-off valve unless specially adapted for that purpose. A true zero governor will always leak gas at no load.

closures or housings. It is necessary to disassemble such equipment at regular intervals for this purpose. And don't forget to clean or change at regular intervals the filters for removing grease or dirt on air blowers, or their filtering function is defeated.

Premix Equipment

The maintenance requirements of premix equipment are somewhat different from those of ordinary atmospheric or blast burners. The mixing device that proportions the air and gas in exact ratios requires regular attention to assure proper functioning. The proportioning valves must operate smoothly so as to respond to small changes in fuel requirements caused by turning a burner on or off.

Maintenance should, therefore, be directed to assuring the necessary film of lubricant between the working surfaces of the valve. Avoid overgreasing, which may cause a build-up on the accurately machined valve parts and thereby alter the mix ratio. Oil all moving parts as recommended by the manufacturer. Also follow good practice in lubricating the motor that drives the compressor.

The fire checks and flame arresters require little maintenance. Clean at regular intervals the series of tightly compressed or wound metal gauzes in the flame arresters, as indicated by the manufacturer. Replacement fuses or disks should be kept on hand for ready use in the event the safety devices operate. Premix machines usually are equipped with filters on the air intake, which must be regularly cleaned or replaced.

The burner equipment on premix systems usually is quite similar to that of blast equipment; therefore the same general precautions stated elsewhere must be observed in order to insure good operation and maintenance.

Protective Equipment

Maintenance of the apparatus that supplies fuel to gas burning equipment consists in large degree of keeping regulators, governors, and control valves in good operating condition.

Many of these controls have operating diaphragms. Most diaphragms today are made of one of the new synthetic materials that is impervious to the type of gas to be handled. They are also usually resistant to the effects of heat up to 150 degrees F. Older installations may have leather diaphragms, which will dry up and become stiff when subjected to heat for a long time. This will result in valves being held in a fixed position, causing poor operation of the burners.

Here are the basic requirements for keeping diaphragms in good operating condition:

1. Keep them as far from the heat as possible.

5

Required Maintenance for Control and Protective Equipment

PART	MAINTENANCE REQUIRED
1. Motor and solenoid valves	Check for sticking or impaired operation. Oil as required. If leaking, repair or replace.
2. Ignition devices	Check for clean spark points. Correct sparkgap, high-tension leakage, or grounds due to dust or carbon. Check for proper placement for lighting pilots. Check to be sure pilot flames immediately, and always lights main flame.
3. Automatic pilot	Shut off pilot and make sure automatic feature functions as it should within specified time limit. If in doubt of satisfactory operation, replace unit.
4. Wiring connections	Check for grounds, open or loose contacts, overloaded wire, sticking relays, defective insulation. Repair or replace as required.
5. Electronic equipment	Check for proper operation as suggested by manufacturers. Replace defective tubes, condensers, or resistors.
6. Gas cocks	Be sure cocks can be turned easily. Lubricate if required. Check for leakage in both open and closed positions. Be sure cocks are always accessible for immediate shutoff in case of emergency.

6

Required Maintenance for Auxiliary Apparatus

PART	MAINTENANCE REQUIRED
1. Heat surfaces in appliances	Remove all soot, dust, rust, or scale and if holes have developed, patch or replace. If burnouts occur, remove cause by changing firing method or combustion adjustment.
2. Secondary air openings	Keep open and unobstructed, and check adjustment to keep over-ventilation of combustion at a minimum. Be sure secondary air is getting to all parts of the gas flame, to complete combustion.
3. Dampers	Same as above. If automatic dampers are used, check operation and readjust when required. Be sure damper is not sticking in bearings or binding in pipe.
4. Flue pipe and building flues	Make sure there is no soot, chimney brick, or mortar closing the flue pipe. Be sure joints are tight and no holes have developed in flue pipe from condensation. Be sure there is no sagging to cause traps in the flue pipe. Be sure roof extensions have not blown down, causing down drafts.

2. Protect controls by asbestos shields where necessary.

3. Oil the diaphragm (if leather) with neatsfoot oil at regular intervals (varying from one-month intervals in hot locations to one-year in cool locations).

Is Poor Installation to Blame?

Poor application or installation of protective equipment often is the cause of faulty operation of gas burning equipment and can materially increase the frequency with which maintenance work will be required.

Points to be watched in this respect are:

1. Don't attempt to install a pilot or protective unit requiring secondary air in a combustion chamber where no secondary air is available, or where the chamber is under more than atmospheric pressure.

2. Don't attempt to use a thermal expansion or thermoelectric-type unit where instantaneous shut-off is desirable. The lag caused by ambient temperatures may slow such an operation down by as much as five minutes, during which time considerable fuel can accumulate in the chamber.

3. Remember that electrical equipment may not operate properly if subjected to serious moisture conditions. This is particularly true of electronic equipment, such as is used in flame-failure equipment, where even a slight moisture film may cause faulty operation by causing current leakage.

4. Don't assume that you know more about the installation than the manufacturer of the equipment, and attempt to short-cut his installation requirements. You cannot expect correct operation unless you install the equipment according to directions.

5. With electrical equipment, be sure that proper voltage is applied. Undervoltage may prevent valves from opening when they should and overvoltage may cause them to remain open when they should close.

6. Don't expect any system to operate properly without satisfactory accessory equipment. Therefore be sure that such parts of the installation as solenoid valves, relays, pilots, and wiring not only are the best procurable but also are kept in good condition.

Explosion hazards are a more serious aspect of a lack of planned maintenance. Oven atmosphere can become laden with an explosive mixture very quickly if ventilation is interrupted.

Combustion safeguards and interlocks do afford a measure of security, but the pitfall in the use of any automatic safeguard is the tendency of operators to tamper with it when operation seems faulty, or if it appears to slow down production. Accidents usually can

7 Symptoms and Causes of Trouble With Protective Devices

SYMPTOM	CAUSE
1. Airflow switch does not open combustion safeguard circuit and shut down fuel input when exhaust fan is stopped	**a.** Vane stuck to seat from condensed vapors **b.** Vane in air stream loaded with residue **c.** Counterbalance improperly adjusted **d.** Mercury switch broken **e.** Switch fouled by intentional blocking
2. Purging cycle does not complete itself before gas pilot can be ignited	**a.** Purging timer setting either too short or intentionally set back (possibly to zero) **b.** Timer by-passed or cut out
3. Pilot cannot be ignited quickly when ignition push button is depressed	**a.** Ignition transformer burned out **b.** High-tension lead to spark terminal loose, broken, disconnected, or grounded **c.** Dielectric for spark terminal cracked, broken, or covered with carbon **d.** Points on spark terminal burned, broken, dislocated, or improperly set
4. Main burner does not ignite readily after pilot has been lighted and main burner valve has opened	**a.** Flame terminal rod may not pierce pilot flame properly **b.** Draft conditions may draw pilot flame away from flame rod **c.** If flame rod supervises only main burner, it may not pierce flame in all its modulated positions **d.** Temperature controlling equipment, including motorized or electric valve, out of adjustment **e.** Tube in flame control cabinet burned out or weak. Flame rod or its leader may be grounded, or flame rod bent or its dielectric broken
5. Door switch on box-type oven does not shut down main burner when door is opened	**a.** Door switch broken or not properly adjusted to function as door is opened
6. Main burner and pilot burner do not go out immediately upon opening of the combustion safeguard circuit by any connected protective device	**a.** Defective tube in flame control cabinet **b.** Electric safety valve or solenoid valve sticking open, or seat obstructed with foreign material or fuel residue **c.** If simple safety pilot is used, thermal-sensitive element may be weak and excessively slow **d.** If a light-sensitive cell is used, it may be defective, or filter may be dirty

be traced to indifferent maintenance of protective devices and failure to determine by periodic tests that each device functions as it should; also to failure to make adjustments or repairs after defects have been disclosed.

Don't condemn the protective equipment in case of difficulty in operation until all possible sources of trouble outside the equipment have been eliminated. Experience has proved that rarely has the equipment itself actually been at fault.

7. Remember that no flame-failure protective device yet developed will do more than check one flame at any particular moment. This means that multiple burners which will not immediately light from one to the other require a separate device for each burner.

A guide for diagnosis of troubles that may develop in protective equipment is given in Table 7.

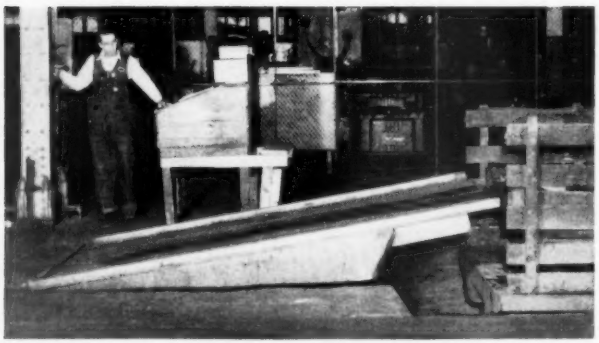
Obviously, trouble shooting as well as preventive maintenance checks and safety apparatus inspections should be handled only by a qualified inspector. Likewise, it is desirable to consult the equipment manufacturer for repair instructions on such equipment as flame combustion safeguards and electronic controls.

One of the best ways to minimize maintenance requirements of gas burning equipment is to provide a trained operator who knows good operating practices and is aware of the numerous costly consequences to production and safety from any careless manipulation of the unit.

OPERATING SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary operating accomplishments. Accepted articles will be paid for

SPECIAL PALLETS ARE USED to transport both oxygen and acetylene cylinders around the plant at Chevrolet Motor Division, General Motors Corporation, Flint, Mich. During transport, and while in storage, the cylinders are kept locked on the pallets by chains. The pallets are designed as an upside-down V so that the cylinders rest on an angle which minimizes the hazard during transport. Fork trucks pick up the pallets and move them from storage areas to their point of use. The pallets hold four cylinders on each side. The hazard of cylinders dropping off is minimized.



FLOATING RAMPS FACILITATE LOADING and unloading of standard road trucks and trailers at the Allis-Chalmers Manufacturing Company, Springfield, Ill. Each of the two deep-well truck docks has a floating ramp which is hinged to the floor at the back end and is raised by an air cylinder operated by the dock dispatcher. The truck is backed into position and the ramp lowered to rest on the edge of the truck bed. The ramp then floats down as the truck is loaded and upward as it is unloaded. Installation of these ramps has resulted in quicker loading and unloading and has made the job safer for employees.

SMOKER'S STATIONS mounted on building columns are contributing their bit to the cause of good housekeeping and fire prevention at the Ivanhoe plant of the Perfection Stove Company, Cleveland. Smoking is permitted on the job, and workers are requested to cooperate by placing butts in the ash trays. Results to date have been gratifying.

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Service Recorders Guide Lift Truck Lubrication

NORMAN J. SHIBLEY, Superintendent of Services, Tapco Plant, Thompson Products, Inc., Cleveland

In the past, our lubrication of lift trucks and other mobile materials handling equipment was done on a weekly and monthly schedule. This did not work out too well because of the frequent turnover in driver personnel. The unfamiliarity of new men with established procedures, or their forgetfulness, resulted in the need for expensive repairs to equipment because of lack of proper lubrication.

To correct this situation, factory engineers from the various equipment manufacturers were consulted. It was found that each engineer recommended a definite time limit, based on hours of operation, after which the equipment should be lubricated. On the basis of this information we installed service recorders on all mobile equipment to provide a record of the actual number of hours of operation.

An index file was set up listing the desirable frequency of lubrication of parts for each piece of equipment. When the hours designated by the manufacturer coincide with

the recorded service hours, a lubrication request is initiated by the materials handling supervisor and the truck is dispatched to the garage. Damage caused by lack of adequate lubrication has been eliminated.

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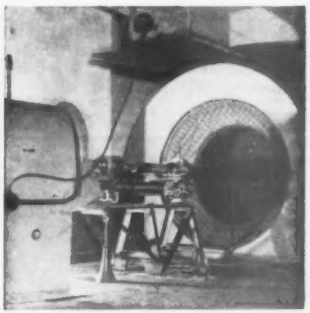
DIRTY RAGS are no longer a problem at the Cleveland plant of Cleveland Graphite Bronze Company. Rag disposal centers, consisting of a porthole opening into a steel barrel, have been established in each tool crib. When a rag needs washing it goes into the barrel and so can easily be collected and taken care of.

PICK-UP BOXES, similar to those used in post offices, are built into the outside wall of the blueprint room at General Motors Truck & Coach Division, Pontiac, Mich. There are 54 boxes—one for each department or individual who constantly orders prints. As soon as the blueprints are run they are placed in the box, and can be picked up at any time by the departmental clerk or individual who has ordered them. Waiting in line at the blueprint window has been eliminated, and the blueprint clerk is relieved of much time-consuming routine.

LESS THAN ONE MINUTE will be needed to cut this 160-lb. bale of crude rubber into eight sections. Before the self-cleaning hydraulic cutter was installed at Hazard Insulated Wire Works Division, the Okonite Company, Wilkes-Barre, Pa., bales were cut by a single-blade knife having a saw-like action, and the same job required 10 minutes of constant attention and handling.



Taking Equipment to Job Cuts Repair Time in Half

C. G. Fyock, Foreman, Facilities Engineering, The Glenn L. Martin Company, Baltimore

Reversing a standard maintenance practice—taking equipment to the work instead of the work to the equipment—reduced an accustomed time expenditure from 65 to about 30 man-days.

Scattered around the plant buildings are 25 large blowers that are part of the plant heating system. Each installation consists of two fans mounted on a horizontal steel shaft. One fan is approximately five feet in diameter and is used to drive heat into the building. The other, about 30 inches in diameter, serves as a smoke eliminator.

The shaft is ten feet long, greatest diameter is five and a half inches, and it weighs about 1600 pounds. During the heating season this shaft turns 24 hours a day. Between the two fans is a bearing that in time produces a worn spot on the shaft about six inches long and from 1/32 to 1/16 of an inch deep.

Formerly, the shaft was removed, taken to another department where the worn area was built up by arc welding, and then transported anywhere from 300 yards to 1/8 of a mile to a 72-in.-bed engine lathe

having a 22-in. swing. After the weld had been turned down to size, the shaft was taken back. Since repairs to the shaft required 65 man-days, the cost of periodically reconditioning in this manner became excessive.

Now the shafts are built up in place with a portable welder. The built-up end is then supported on a 36-in.-bed bench lathe with a 9-in. swing. This lathe is mounted on a stand made of angle iron, which is anchored to the floor with 3/8-in. expansion shields.

Power for turning the shaft is furnished by a 1-hp. motor with built-in reduction gear, and transmitted to the shaft by a leather belt running over a V-belt pulley. This pulley, which is split, is clamped tightly around the blower shaft.

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Executives Hold Daily Mail Opening Conference

Plant operating executives of Woodward Governor Company, Rockford, Ill., must attend a mail opening conference as the first order of business in each day's activity. Included in the group are the president and general manager, chief engineer, production manager, sales manager, purchasing agent, plant manager, finance manager, service manager, and divisional sales manager. At these meetings, most of the mail from customers and field servicemen is opened and read by each member of the group.

Thus heads of departments are kept informed concerning orders, service problems, and customer's reaction to company products, policies, and servicing. The production manager, for instance, is intimately informed as to how orders are being received and what to expect in the way of production schedules. The engineering division gets first-hand information concerning product design and field service problems.

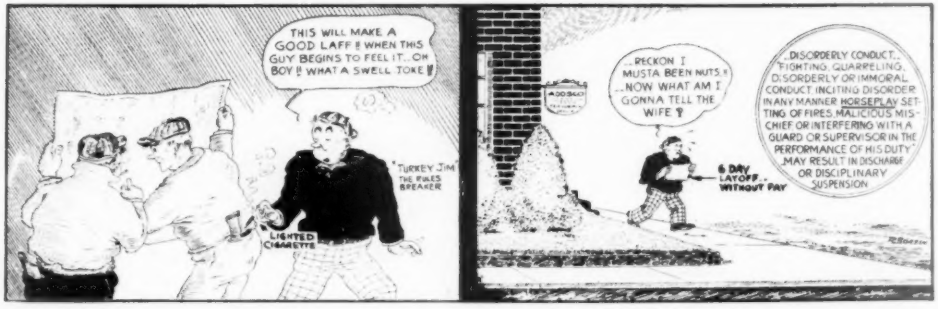
Every type of problem relating to efficient operation of the business can be discussed and proper action quickly decided upon.

Wire Recorders Collect Data for Inventory

To speed inventory of its transformer section, the Southern California Edison Company, Los Angeles, used portable wire recorders in combination with punched card tabulating machines.

Since inventory is controlled by ledger postings according to transformer and serial number, open items from the ledgers were keypunched into tabulating cards. Then, on inventory day, four recorders with a capacity of one hour's continuous dictation each, were set up in the transformer department. The final inventory record time was about 48 hours.

As the recorder spools were filled, they were sent to key punch operators, who put the verbally recorded data on a second set of cards. A tabulating machine sorted the two sets, separating the nonmatching cards from those that tallied for further investigation.


THIS WILL MAKE A GOOD LAFF IF WHEN THIS GUY BEGINS TO FEEL IT...OH BOY! WHAT A SWELL JOKE!
TURKEY JIM THE RULES BREAKER
LIGHTED CIGARETTE
...RECKON I MUSTA BEEN NUTS!! ...NOW WHAT AM I GONNA TELL THE WIFE?
6 DAY LAYOFF - WITHOUT PAY
...DISORDERLY CONDUCT... "FIGHTING, QUARRELING, DISORDERLY OR IMMORAL CONDUCT INCITING DISORDER IN ANY MANNER HORSEPLAY SETTING OF FIRES MALICIOUS MISCHIEF OR INTERFERING WITH A GUARD OR SUPERVISOR IN THE PERFORMANCE OF HIS DUTY" ...MAY RESULT IN DISCHARGE OR DISCIPLINARY SUSPENSION

Turkey Jim, Cartoon-Character, Helps Dramatize Company Rules

A cartoon-character, Turkey Jim, has helped Alabama Dry Dock & Shipbuilding Company, Mobile, get company rules across to its employees.

Turkey constantly breaks company rules and safety regulations. He violates provisions of the labor contract. His antics have established him in the eyes of ADDSCO as a notorious character. Once in a while, just for a change, he does something right. Then he is commended accordingly.

Turkey Jim is featured in the employees' weekly publication, "Fore and Aft." In addition, several of the more effective cartoons were combined in a booklet entitled "The Worst Guy You Ever Met." This booklet is used in connection with indoctrination of new employees.

ADDSCO finds that Turkey Jim has been of great assistance in putting across its program to acquaint employees with plant regulations, safety rules, and important provisions of the labor contract. Employees like "the light touch."

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Causes and Remedies for Troubles With Lead-Acid Storage Batteries

INFORMATION GIVEN on this and the following pages will save time in determining the cause of substandard performance of lead-acid batteries in motive power service. If followed, the recommendations will add materially to the life of such batteries.

All possible sources of battery trouble are not considered here, but the most common ones are listed. They will serve as a check list and starting point for the initial investigation into the cause of unsatisfactory performance.

Caution: Make sure that a cell or battery is in fully charged condition before adjustment of acid is attempted.

SYMPTOM AND POSSIBLE CAUSES	REMEDY
I. Battery will not take a charge	
1. D.c. charging circuit fuse blown or missing	1. Replace with good fuse
2. Open circuit in charging circuit	
(*a*) Broken wire	2. Locate and repair
(*b*) Open in charging receptacle or plug	
(*c*) Loose connection of cable to stud	
3. A.c. line fuses blown or missing	3. Replace with good fuses
4. A.c. line switch open	4. Close switch, and prevent unauthorized persons tampering with it
5. Open circuit in control lead or circuit, preventing contactor from pulling in	5. Locate and repair
6. Charging plug not pushed all the way into receptacle	6. Instruct person on how to connect battery properly to charging source
7. Charging rate too low	7. Check ammeter for accuracy. See section, "Battery takes too long to charge"
8. No voltage output of generator	8.
(*a*) Check field circuit	(*a*) If open, correct
(*b*) Check brush contact to armature	(*b*) Correct by replacing brushes or adjusting so they do not stick
9. Bus voltage too low	9. Determine cause and correct
(*a*) May be due to incorrect tap setting in a rectifier	
(*b*) Too-low voltage from generator	
10. With initial equipment, connections to charging receptacle reversed	10. Reverse leads (CAUTION: Open battery circuit first)
II. Battery takes too long to charge	
1. Poor connection in charging circuit	1. Check lugs, bolted connections, charging leads, plugs, and receptacles for high-resistance joints, and correct
2. Over-discharged battery placed on charge	2. Do not discharge below 1.140
3. With two-rate charging, charging equipment does not provide high-start rate	3. Check for open in control circuit to provide high rate. Determine cause and correct
4. With two-rate rectifier charging equipment—	4. Determine cause and correct
(*a*) Voltage relay connected for smaller number of cells than in battery	(*a*) Connect relay for same number of cells as in battery
(*b*) Applied a.c. voltage too low under load condition	(*b*) Install greater capacity line to rectifier to reduce *IR* drop; or relocate rectifier nearer to incoming a.c. source
(*c*) Primary transformer taps not set for voltage applied	(*c*) Restudy and place transformer taps for applied voltage
(*d*) Unnecessary switch in line turned off by unauthorized person	(*d*) Eliminate switch
(*e*) Voltage relay operating below standard voltage	(*e*) Adjust relay to operate at equivalent of 2.37 volts per cell at 77 degrees F.
(*f*) Start of charging rate too low	(*f*) Adjust to proper value
(*g*) End of charging rate too low	(*g*) Adjust to proper value
(*h*) Start of charging rate too high	(*h*) Reduce to not exceed 3½ to 4½ times published finishing rate

Continued on page 144

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Causes and Remedies for Troubles With Lead-Acid Storage Batteries

Continued from page 143

SYMPTOM AND POSSIBLE CAUSES	REMEDY
5. Where voltage relay is used in control circuit for two-rate charge, temperature of charging control equipment may be materially higher than battery operating temperature	5. Study and take corrective action (*a*) Reduce or eliminate source of heat to charging control equipment (*b*) Provide better ventilation for charging equipment (*c*) Relocate charging control equipment to area where atmospheric temperature is practically the same as temperature where battery operates
6. Modified constant-voltage charging (*a*) Bus voltage too low	6. Determine cause and correct (*a*) Check panel voltmeter for accuracy at operating voltage, and adjust bus voltage to correct value
(*b*) Bus voltage decreases as load decreases	(*b*) Adjust generator for flat characteristic
(*c*) Ballast resistance too great	(*c*) Reduce resistance to proper value
7. Charging leads reversed, or charging equipment polarity reversed	7. Correct polarity and charge battery in correct direction
8. Battery not placed on proper charging circuit when installation has different sizes of batteries	8. Number or letter charging circuits and batteries. Improve supervision and assign respective batteries to proper circuits
9. Charge not terminated when battery is fully charged	9. Determine cause and correct
III. Battery will not work full shift	
1. Uneven cell voltages and specific gravity	1. Give an equalizing charge
2. Low electrolyte levels	2. See section, "Low electrolyte level"
3. Battery not charged before going in service	3. Check charging schedules. Do not put discharged battery in service. Set up work schedules
4. Two or more battery leakers in steel tray	4. Replace broken jars
5. One or more cells cut out of battery	5. Repair, charge, adjust acid, and place in battery
6. Battery with incorrect number of cells assigned to equipment	6. Apply battery of proper voltage
7. Specific gravity at full charge below normal	7. Adjust specific gravity to normal
8. Battery worn out	8. Replace battery
9. Impurities in electrolyte	9. Add only distilled or approved water
10. New operator "riding" brake	10. Discourage such practice
11. Using reverse instead of brakes	11. Discourage such practice and keep brakes in good operating condition
12. New motorman or operator	12. Instruct how to conserve power
13. Load too great	13. Use larger battery
14. Wheels, axles, and bearings need grease	14. Establish planned greasing and oiling schedule for equipment
15. Tires under-inflated	15. Establish schedule for periodic check of air pressure
16. Brakes dragging	16. Adjust brakes properly
17. Dirty tracks (mine locomotive)	17. Remove coal from tracks
18. Deeply grooved wheels	18. Replace with new or rebuilt wheels
19. Deep ruts in roadbed	19. Fill in ruts so that bottom of car does not drag
20. Series field in motor shorted or grounded	20. Replace field and remove grounds
21. Armature needs repairs	21. Replace or repair armature
22. Grounds on equipment	22. Clear grounds and insulate wiring
23. Excessive grades	23. Install larger battery, or change battery charging schedule
24. Service required exceeds capacity of equipment	24. Assign equipment to work for which it was designed
25. When batteries are in two halves: Discharged half is paired with a charged half	25. Better supervision. Keep batteries properly paired
26. Uneven number of cells in the two halves, where split batteries are used in parallel-start series-run control circuits	26. Put equal number of cells in each half of battery

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maintenance data sheet 161

Causes and Remedies for Troubles With Lead-Acid Storage Batteries

SYMPTOM AND POSSIBLE CAUSES	REMEDY
IV. Battery overheats on charge	
1. Finish rate too high	1. Reduce finish rate to normal
2. High-charge rate on too long	2. Reduce voltage operating point of voltage relay
3. Timer turned all the way each time	3. Set timer for correct setting, from chart
4. Ampere-hourmeter set by guess	4. Use ampere-hour charging chart
5. Per cent overcharge setting of ampere-hourmeter too high	5. Reduce to 12 per cent
6. Timer set for too many hours	6. Reduce timer setting
7. Two-rate charge did not change over to low rate	7. Determine cause and correct (*a*) Check operation of voltage relay or replace relay (*b*) Check for open voltage relay circuit (*c*) Check for open in change rate control lead (*d*) See whether voltage relay is connected for same number of cells as in battery
8. High bus voltage	8. Check voltmeter at operating point and reduce voltage to correct value
9. Too-high charge rate	9. Check ammeter for accuracy at operating point and reduce current to normal
10. Charge not stopped—automatic mechanism does not terminate charge	10. Locate cause and correct (*a*) See that voltage relay is connected for same number of cells as in battery (*b*) Check timing mechanism, or replace (*c*) Check for open in control leads (*d*) Check operation of voltage relay. Adjust to correct value, or replace (*e*) Check ampere-hourmeter for accuracy and operation at low rates. Have it cleaned and recalibrated
11. Poor ventilation	11. Remove cover from battery during charge. Ventilate battery room. Intake or exhaust fan may improve ventilation. Raise batteries off wood platform rack
12. Separators worn through	12. Replace separators or battery
13. Sediment space filled	13. Remove sediment or replace battery
14. Internal shunt	14. Remove shunt
15. Fully charged specific gravity is below normal, and attendant continues charge, endeavoring to increase specific gravity	15. Make acid adjustment to specific gravity, and restore to normal
V. Battery overheats on discharge	
1. Over-discharge	1. Limit discharge to 1.140. Use more batteries. Set up schedule for recharging
2. Battery too small	2. Use larger-capacity battery
3. Poor ventilation	3. Keep ventilation ports open
4. Poor burn of connectors to cell terminals	4. Replace poor burns
5. Excessive load	5. Grease wheels and bearings of equipment. Determine cause of excessive load and correct. Do not exceed capacity equipment is designed for
6. Battery worn out	6. Replace battery
7. Separators worn through	7. Replace separators
8. Internal shunt	8. Remove shunt
9. Battery capacity temporarily reduced because of low fully charged specific gravity	9. Restore full-charged specific gravity to normal
10. Battery not fully charged before being put in service, resulting in over-discharging	10. More complete regular charges
11. Electrolyte levels low	11. Add water to proper height, as required. Do not put battery in service when electrolyte levels are below top of plates

Continued on page 146

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maintenance data sheet 162

Causes and Remedies for Troubles With Lead-Acid Storage Batteries

Continued from page 145

SYMPTOM AND POSSIBLE CAUSES	REMEDY
12. When overheating is confined to a few cells near resistance	12. Provide heat-insulating material between resistance and cells, with air circulating space between
13. Operation in high atmospheric temperature	13. Provide cool location for charging, with good ventilation
VI. Low electrolyte level	
1. Broken or cracked jar	1. Replace jar
2. Water additions neglected	2. Better supervision. Add water as required so that levels do not drop below top of plates
3. Cell missed when adding water	3. Caution attendant to exercise more care
4. Too much over-charging	4.
(*a*) If automatically controlled:	(*a*)
1. Voltage relay set for greater number of cells than in battery	1. Connect relay for proper number of cells
2. Timer set for too many hours	2. Reduce time
3. Voltage change rate relay operating at too-high voltage	3. Reduce voltage value at which relay operates
(*b*) If manually controlled	(*b*) Terminate daily charge when specific gravity is 10 points below last equalizing charge value. Change from high rate to low rate when specific gravity reaches 1.200
VII. Unequal cell voltages	
1. Over-discharge	1. Give an equalizing charge and do not discharge below 1.140
2. Lack of equalizing charges	2. Give an equalizing charge periodically
3. Internal shunt	3. Make internal inspection of low-voltage cell and correct cause. Check for split separator and moss short
4. Top of battery very dirty	4. Neutralize and clean top of battery
5. Cells operated with low electrolyte level	5. Add water as required so that tops of plates are not exposed. Give equalizing charge
6. Low fully charged specific gravity of cell	6. Acid adjustment after an equalizing charge
7. Sediment space filled	7. Replace battery
8. Positive plates worn out	8. Replace battery
9. Half tap on cells for lower-voltage circuit	9. Remove tap and connect load to battery terminals through resistance
10. External source heating certain cells, such as charging resistance on combination locomotive, or controller control resistance under battery	10. Install heat-insulating material between resistance and battery
11. Poor contact in controller on split-circuit batteries (parallel and series on discharge, all series on charge)	11. Locate poor contact and correct
12. Impurities in cell	12. Add only distilled water, or water from an approved source
13. Variation in charging rate	13. Endeavor to take readings when charge rate is constant
14. Also see, "Unequal specific gravity between cells"	14. See corrective action under "Unequal specific gravity between cells"
VIII. Unequal specific gravity between cells	
1. All items under "Unequal cell voltages" may be cause	1. See corrective action under "Unequal cell voltages"
2. Overfilling with water	2. Do not fill above high level. Give equalizing charge and adjust acid
3. Operating cell with cracked jar	3. Replace jar and adjust acid
4. Acid not adjusted properly when jar was changed	4. Adjust acid
5. Operating battery with vent caps out of place	5. Keep vent caps securely in place. Give equalizing charge and adjust acid
6. Sealing compound leaks	6. Reseal and adjust acid
7. Operating battery with broken cover	7. Replace cover and adjust acid
8. Neutralizing material in cell	8. Keep vent caps in place at all times, except when adding water. Keep battery clean

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CLARK ELEC-CARLOADER FORK LIFT TRUCK

CLARK FORK LIFT TRUCK

Materials move faster and at a saving with Battery Electric Trucks and EXIDE-IRONCLAD BATTERIES

With this efficient, cost-cutting team at work in your plant, materials can be handled in greater volume, with maximum safety and at a saving of 50% or more. Battery electric trucks help speed up production by eliminating material handling bottlenecks. They change floor space from *square* feet to *cubic* feet through higher tiering. And when the motive power is Exide-Ironclad Batteries you get steady, uninterrupted service straight through to the end of every shift.

EXIDE-IRONCLAD Batteries are DIFFERENT ... in CONSTRUCTION ... in PERFORMANCE. They have ALL FOUR of the characteristics a storage battery must have to assure maximum performance from battery electric trucks—high power ability, high electrical efficiency, ruggedness and a long life with minimum maintenance. The combination of these Exide-Ironclad characteristics assures years of dependable day-in, day-out service.

Write for further particulars and FREE copy of Exide-Ironclad Topics which contains latest developments in material handling and shows actual case histories.

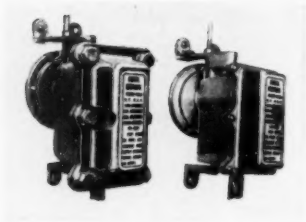
1888...DEPENDABLE BATTERIES FOR 61 YEARS...1949

"Exide-Ironclad" *Reg. Trade-mark U. S. Pat. Off.*

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

WHAT'S NEW IN EQUIPMENT

Briefed here—for the convenience of plant operating men—are descriptions of industrial plant equipment newly placed on the market



Pressure Controls

Explosion-, dust-, and splash-proof sensitive static pressure controls are suitable for use on very low pressures where regulation is required in inches of water, either pressure or vacuum. May be used to control static pressure in the intake of a duct, to measure and actuate alarm when drop across filter reaches a predetermined value, etc. Obtainable in standard ratings up to 20 inches of water-column pressure or vacuum with range adjustment, and with fixed or variable differentials of 0.2 to 2 inches of water. Also available with double-throw circuits or floating contacts for reversing-type damper control motors. Coral Designs, Box 248, Forest Hills, N. Y.

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Hose

Labeled "Ortac," all-purpose hose for carrying air, water, oil, gasoline, or acids of low concentration and temperature is made with vertically braided rayon carcass and oil-resisting synthetic tube, friction, and cover. Sizes range from 1/16- to 1½-in. I.D. Goodyear Tire & Rubber Co., Akron, O.

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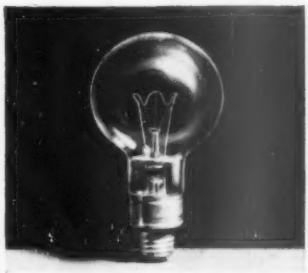

Lamps

Two infra red lamps have been added to manufacturer's line of industrial processing lamps. The 500-watt globe-shaped type (illustrated) has 5-in. light-center length, meets requirements of open-reflector ovens. The other, a 375-watt lamp, has a self - contained reflector and is equipped with a heat-resistant bulb which minimizes breakage from splashing water or other liquids. Both are designed to provide smooth distribution and high utilization of radiant energy. Lamp Dept., General Electric Co., Nela Park, Cleveland 12.

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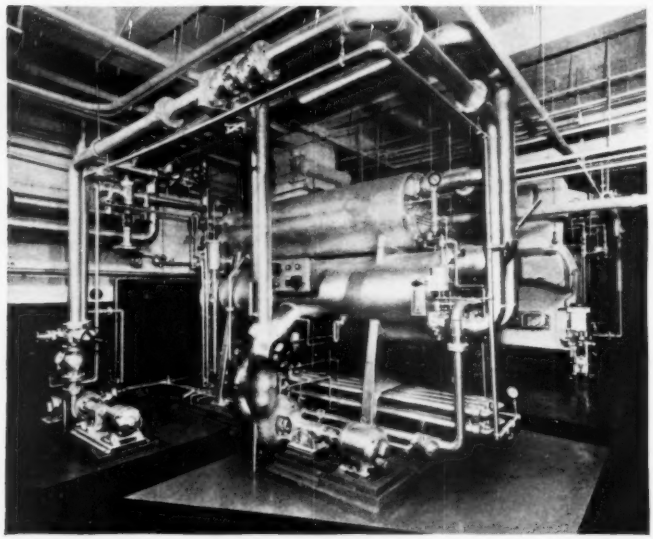
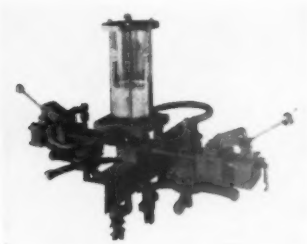


Steam Refrigerating Machine

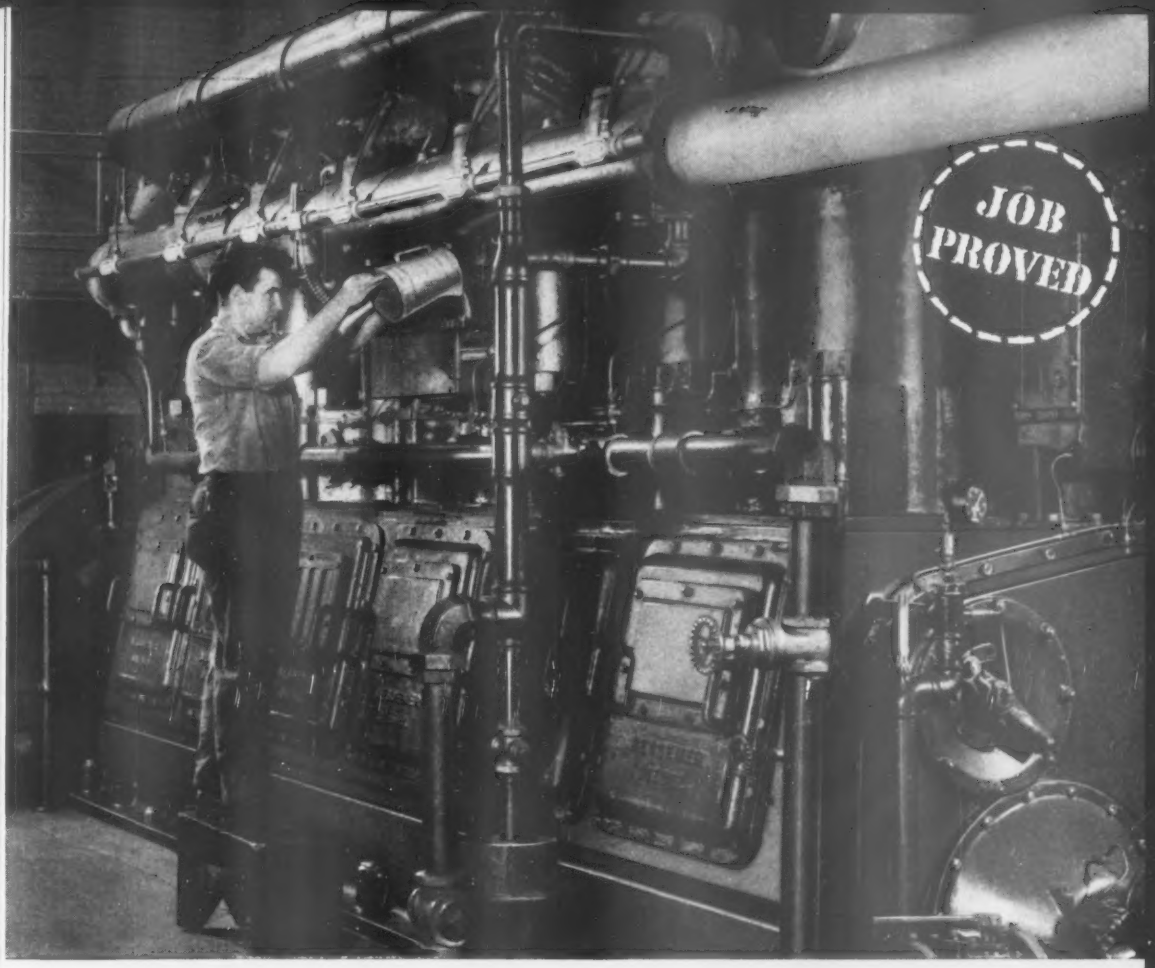
Using plain water as a refrigerant and a simple salt as an absorbent, refrigerating machine employs steam for air conditioning purposes, providing a balance in steam loads for summer cooling and winter heating. Unit is an absorption machine and will operate on either high or low pressure steam, or even low pressure waste steam, according to the maker. Aside from a small solution pump it has no moving parts, is practically noiseless and vibrationless. Available in 115-, 150-, and 200-ton-capacity units.

Manufacturer states that single units will air condition areas from 34,500 to 60,000 square feet, and will cool water to as low as 36 degrees F. Machine is light in weight, may be installed on rooftops or intermediate floors, as well as in basements. It is claimed that it uses less than 20 pounds of steam per hour per ton of refrigeration, no matter what the steam pressure, and adjusts itself automatically to partial loads down to 15 per cent of total capacity, without loss of efficiency. Adaptable to multi-unit installations when higher tonnages are required. Carrier Corp., Syracuse, N. Y.



Trolley-Conveyor Lubricator

Self-contained automatic grease lubricator, designed for use on trolley conveyors, requires no external power for operation, but is driven by contact with trolley wheels. Identified as Model 304, it features a transparent plastic reservoir, release lever for taking lubricator out of service, and uses either a spring follower or air pressure on the reservoir for



4,200 HOURS' OPERATION—STILL SLUDGE-FREE

Sun Diesel Lubricating Oil Almost Good As New After Outlasting a Competitive Product 5 to 1

A prominent manufacturer uses 6-cylinder, 4-cycle diesels to generate power. Recently, at the suggestion of one of our engineers, a Sun diesel lubricating oil was tried in one of the units.

Results were impressive. Inspected after three months, the engine was found to be in the cleanest condition since installed. In tests run against competitive oils, one manufacturer's product sludged up in 600 hours. Yet the Sun oil was practically as good as new after 3,000 hours, showing but a slight increase in neutralization number. In further tests, the Sun oil ran 4,200 hours in six months' operation without a change; the engine remained clean and sludge-free, and showed no signs of wear.

On the basis of this performance, the plant has extended the use of Sun oil to other diesel units.

Here is just one example of the records being set by Sun "Job Proved" lubricants in all their wide applications. You can rely on Sun products to keep diesels, turbines, steam engines and other power equipment operating smoothly and with minimum maintenance. To get complete information call the nearest Sun Office. For Technical Bulletin "Lubrication of Diesel Engines," write Department F-7.

SUN OIL COMPANY • *Philadelphia 3, Pa.*

In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

forcing lubricant into pumping unit. As a trolley wheel approaches the lubricator, its hub brings one of five pumping units into contact with the wheel bearing, which is given a measured quantity of lubricant. As one wheel is greased, a cam in the pump housing snaps another pumping unit into position to contact the next wheel. Unit will operate on conveyor wheels; with or without Zerk hydraulic fittings. J. N. Fauver Co., 49 W. Hancock, Detroit 1.

•

Paint and Air Heater

Explosion-proof Model U paint and air heaters for spraying paints, lacquers and synthetics, uses aluminum instead of water or other liquid as the heat transfer agent between two 1000-watt cartridge-type heaters, paint heating coils, and air heating coils. Glass wool insulation prevents heat loss, and sheet-steel outer shell provides protection against damage. Manufacturer states that the heater comes up to operating temperature within 15 minutes, and is maintained at pre-set heat by a thermostat and thermoswitch. Capacity is approximately eight gph. Circulating system, for use with longer paint hoses or for intermittent spraying, is also available. Bede Products, Inc., 4311 Ridge Rd., Cleveland 9.

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Magnetic Trap

Permanent nonelectric magnetic separator, designed to eliminate tramp iron damage and ferrous contamination to processing equipment such as pumps, screens, and grinders. Available in 2-, 3-, or 4-in. pipeline sizes, with flanged or threaded ends. They consist of a magnetic element and a cast housing which will withstand pressures up to 75 pounds. Standard housing is cast bronze; also available in cataract metal, a copper-nickel base alloy developed to resist acids, alkalies, mixtures, and organic compounds. Eriez Mfg. Co., 723 E. 12th St., Erie, Pa.

•

Protective Metallic Roof Coating

Liquid elastic metallic foil, called Permalume, was developed as a flexible seamless protective coating for asphalt roofing. Made of aluminum or copper in a hydro-carbon base, it may be used as heat and light reflective insulation, metal coating, expansion joint filler, or to replace membrane waterproofing. Since it contains no oils, it is nonoxidizing, heat and light stable, acid and alkali resistant, and will not support mold or fungus. Prepared in liquid form, it may be sprayed, brushed, or mopped on in any desired thickness to form a bright uniform foil that bonds inseparably over any surface, and will not blister, crack, peel, or check, according to maker. Grems Mfg. Co., 220 Spring St., Klamath Falls, Ore.

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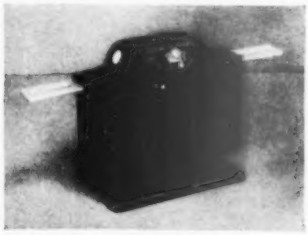

Butyl-Molded Transformer

Butyl-molded transformer, the JKM-3, is designed for indoor metering and relay services. Rated 5000 volts at 25-60 cycles, it is available with single primary in ratings from 10 to 800 amperes. The butyl compound, injected under high pressure into areas around core, coils, and terminals, permanently positions these components, and is said to provide a homogeneous insulation that is resilient, oxidation-resistant, arc-resisting, and resistant to moisture. Transparent plastic terminal cover cannot be put in place when short-circuit switch is closed and meters or other devices connected. Dimensions make this transformer interchangeable with others. Meter and Instrument Divs., General Electric Co., Schenectady 5, N. Y.

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Plastic-Roller Conveyor

Lightweight portable conveyor combines plastic rollers with magnesium or aluminum frame. Ten-inch carrying surface with 2-in.-diameter rollers is set on 4-in. centers. Rollers extend full width of cartons, and manufacturer states unit may be used to handle boxes and cartons made of light-grade cardboard, or reused cartons which may have become soft. Convevor weighs 32 pounds; distributed load capacity is 500 pounds per 10-ft. section. Alvey Conveyor Mfg. Co., 3201 S. Broadway, St. Louis, Mo.

Pipe Plugs

Hex socket pipe plugs are designed to eliminate sealing failures in gas or liquid lines. For use with dryseal taps, plugs were developed for conditions where a perfect seal is essential, for extreme pressure, or where sealing compound cannot be used. They are pressure-formed and threaded, with cold-drawn heads and smooth, perpendicular walls. Available in sizes from 1/16 to 1¼ inches. The Allen Mfg. Co., Hartford 1, Conn.

•

Conveyor Belt

Four-ply rayon carcass structure of conveyor belt is said to make it

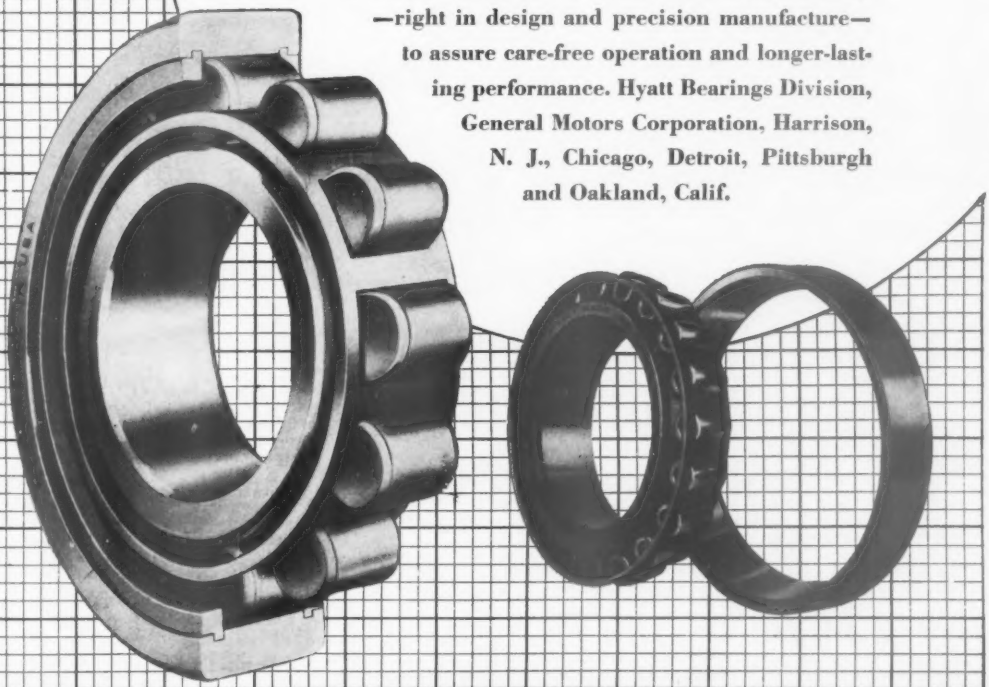
HYATT... Always as new as next month

Hyatt invented the roller bearing fifty-seven years ago.

Here at the birthplace, ever since, Hyatt has designed and produced roller bearings that are as new as next month.

As fast as design-engineers moved on to new products, a newer, better bearing was ready for them at Hyatt.

So during these many years, designers and builders of every type of machine or equipment requiring roller bearings have looked to Hyatt for the right bearings —right in design and precision manufacture— to assure care-free operation and longer-lasting performance. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., Chicago, Detroit, Pittsburgh and Oakland, Calif.



HYATT ROLLER BEARINGS

highly flexible, strong, and particularly adaptable to underground operations. Manufacturer states that its unusual strength permits use of belt systems with longer centers, pulley to pulley, reducing number of transfer points and drives required. Made in 26- and 30-in. widths, and features mildew resistance and acid neutralization. Goodyear Tire & Rubber Co., Akron, O.

•

Germicidal Lamp

For use in low-temperature areas, germicidal lamps, called Zeroline, are available in 16- and 30-in. models. Manufacturer claims that construction, size, and jacketing make lamps effective even at near-zero temperatures, and life duration is rated at 800 hours. Hanovia Chemical & Mfg. Co., Germicidal Lamp Div., Newark 5, N. J.

•

Annunciator

Supervisory annunciator, called No. 1518 Pull's-Eye, gives both visual and audible warning of overheated bearings, low fuel level, too low or too high pressures or temperatures, end of a processing cycle, or similar conditions. Electrical impulse is received by lamp-type annunciator from normally open or normally closed contact, such as thermostat or float switch. Maintaining contact in circuit then indicates location of trouble on the board and simultaneously sounds an audible alarm. Designed for flush, surface, or panel mounting, open or closed circuit operation, on voltages from 24 to 250 volts, a.c. or d.c. Visible signals are 1-in. lamps, identified by engraved lamicoid nameplates. Auth Electric Co., Inc., 34-20 45th St., Long Island City 1, N. Y.

•

Metal Shear

Cam-and-lever-actuated shear cuts off flat strip stock with punch and die accuracy and precision, according to maker, and may be used wherever flat, smooth, square-cut edges are required for accurate alignment. Will cut off band saw blades up to 0.045-in. thick and 1¼-in. wide. Can be mounted on the saw or permanently affixed to wall or bench. Three hardened shear blades may be removed for resharpening. The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

•

Aluminum Welding Alloy

Designed for torch welding of aluminum, thin-flowing alloy, called Eutec-Aluminum-Weld, may be used for lap- and slip-type welds or for joining thin parts. Manufacturer claims that finished weld is corrosion resistant and has good color match. Provided in a container called Economizer Kit, containing 400 feet of 1/32-in. alloy in coil form and a jar of special aluminum-welding flux. Eutectic Welding Alloys Corp., 40 Worth St., New York 13.

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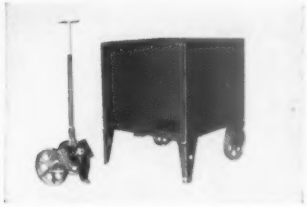

Scrap Truck

Designed to be used with revolving-head fork lift truck, scrap truck consists of a bin-like superstructure of heavy steel plate panels welded to a flat steel deck truck, called Transport. Fabricated steel channels which accommodate forks of standard lift trucks extend from front to rear panels just above the deck. Unit may be picked up from either front or back, turned to any angle or upside down, yet remains entirely secure, according to manufacturer. Factory Service Co., 4633 N. 21st St., Milwaukee 9.

•

Steam Cleaner

Requiring only 27x37 inches of floor space, steam cleaner, called "Service Master Hypressure Jenny," develops 80 to 120 pounds of working pressure, according to maker. Normal 45-gph. capacity can be stepped up to 240 gph. by means of accessory called Adjusta-Blast Gun. Features include quick starting and steaming, automatic nozzle control, and selective compound and fuel feed. Oil fired and electric motor driven. Homestead Valve Mfg. Co., Coraopolis, Pa.

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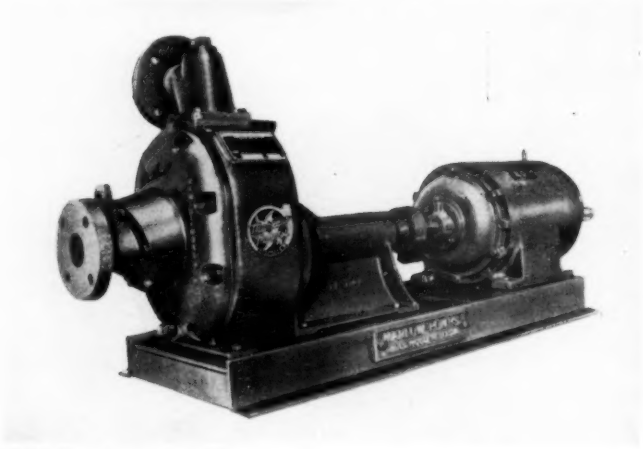
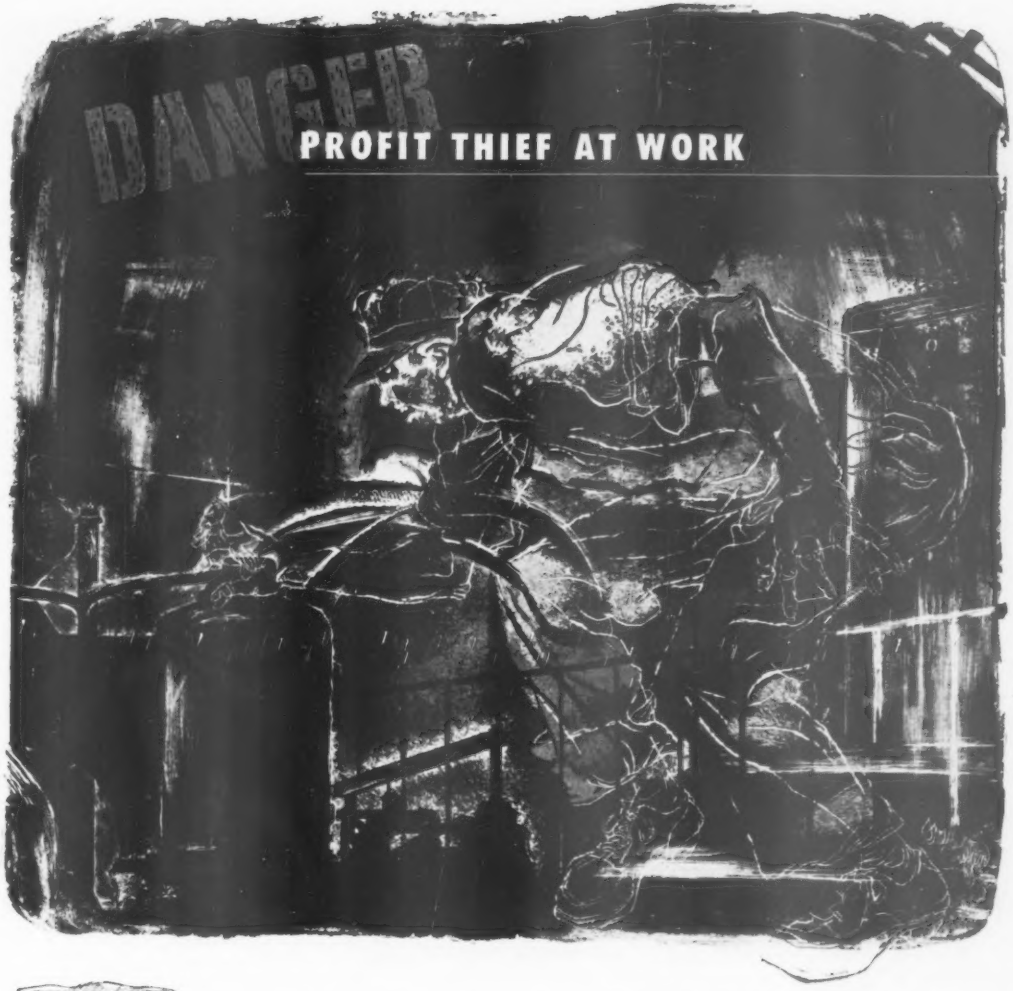


Self-Priming Pumps

Series of self-priming centrifugal pumps includes 26 basic types available in many modifications and combinations of mountings, fittings, and materials. Various models available: electric horizontal long-coupled; vertical and horizontal close-coupled; portable and stationary engine-driven; and belt-driven. All feature free-flow design and "diffuser" automatic priming. Entire line also available with engine drive. Low-pressure sizes, 1½ to 10 inches, have capacities from 50 to 4000 gpm.; high-pressure models 2 to 6 inches have capacities from 50 to 1000 gpm. Marlow Pumps, Ridgewood, N. J.

Exhaust Fans

Line of six ball-bearing belt-driven exhaust fans includes 36-, 42-, and 48-in. sizes. Equipped with ball-bearing motors and ball-bearing pillow blocks to absorb the thrust load of the fan, they are suitable for in-



He's a particularly vicious thief. He preys on machines in plants of all kinds all over the country—slowing production, slashing profits, collecting an enormous toll from industry.

You think he's not at work in *your* plant? It will pay you to be suspicious enough to find out *for sure*—for his ways are devious.

For example . . . here are some places to look.

Are the grease guns in your plant still being filled by old-time "paddle" methods—wasting time, wasting grease, risking contamination and dirt? You've caught a suspect!

You can save 3¾ man hours for every 100 lbs of grease and eliminate contamination risks.

Are you lubricating machines by "hand and muscle"—the old, time-wasting, hit-or-miss method? Here's evidence of thievery!

You can save as much as 23.9 man hours in applying each 100 lbs. of grease!

What about the cost of "down-time"—when a bearing burns, a gear fails, precision is "off" because of faulty or inadequate lubrication? Thievery again!

You can eliminate human error—make sure that each lubrication point gets the correct grease, in an accurately measured amount and at the proper time.

Have you any suspicions that there is a profit thief loose in your plant? Is he hiding behind the mask of faulty, old-time, costly lubrication methods—robbing you just as surely as though he "tapped the till"?

There's one proven way to stop this loss.

An Alemite representative can tell you in 10 minutes how Alemite Methods will simplify and better organize your lubrication procedures. He can show you how mechanized lubrication from barrel-to-bearing will increase your production and profits.

Telephone your Alemite Distributor. Or write to Alemite, 1835 Diversey Parkway, Chicago 14, Illinois.

ALEMITE

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Another Product of STEWART WARNER

MODERN LUBRICATION METHODS THAT CUT PRODUCTION COSTS

stallation to discharge vertically, horizontally, or at any angle without injury to motor or fan-blade assembly and without reduction in efficiency, according to manufacturer. Capacities range from 10,200 to 19,350 cfm. of air. They are powered with capacitor motors, rubber-hub mounted to insulate noises, and have automatic thermal protectors to prevent overloading. Automatic ceiling shutters are available for use when fans are mounted to discharge vertically. The Emerson Electric Mfg. Co., 8110 Florissant Ave., St. Louis, Mo.

•

Fuel-Oil Preheater

Heating device for use in the oil line to alter the viscosity of heavy oils so they can be used efficiently in burners designed for lighter oils. Manufacturer states that unit is capable of heating No. 5 or No. 6 oils at the rate of approximately 50 gph. If burner consumption is less, excess heated oil is by-passed through relief valve to storage tank, lowering the viscosity of the stored oil. Inlet and outlet connections are located at the front to facilitate installation. Unit is equipped with a 4000-watt heating unit operating on 220 or 440 volts. Boyar Products Corp., 104 E. St. Charles Rd., Lombard, Ill.

•

Portable Insulation Resistance Tester

Self-contained portable electronically controlled insulation resistance tester provides a range from zero to 100 megohms. Device operates without batteries; small hand crank turned at moderate speed actuates a.c. brushless-type generator. Maker claims uniform testing voltage approximating 500 volts d.c. is provided over a wide range of cranking speeds by electronic control. Red lights indicate when correct testing voltage is being delivered, and built-in guard circuit is said to prevent surface leakage from affecting measurements. Device, 3⅜x6x3¼ inches, weighs three pounds. Housed in die-cast aluminum case, with strap-leather carrying case. Two neoprene-covered lead wires, ten feet long, color-coded; alligator-type clips. Holtzer-Cabot, Inc., 125 Amory St., Boston 19.

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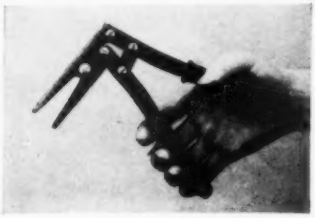

Double-Action Pliers

Flexible jaws of pliers can be shifted to various angles within radius of 110 degrees to be used in different positions and in inaccessible places. Spring action releases heat-treated chrome molybdenum steel jaws automatically. Jaws serrated to hold securely, handles rubber covered for comfort. Length, 10¾ inches; weight, 8½ ounces. Industrial Products Co., 2820 N. 4th St., Philadelphia 33.

•

Hydraulic Forks

Palletless hydraulically operated load-handling forks for lifting various materials are available as attachments for all models of manufacturer's fork lift trucks. Called "all-purpose" gripping forks, they come in three styles: two forks for holding sides of a barrel or unit load of package goods; four rubber padded forks for gripping bottom tiers of a load of bricks; and four semi-curved forks for lifting two rows of bags. The Buda Co., Dept. LF, Harvey, Ill.

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Tapes

Two electrical adhesive tapes have high dielectric strength, are moisture resistant. Plastic-backed tape with dielectric strength of over 10,000 volts, called Polyken No. 822, can be used in place of splicing tapes or compounds combined with friction tape. It is 0.009-in. thick, conforms closely to contours, has a tensile strength of 22 pounds per inch of width. No. 163 has a dielectric strength of 2000 volts, is thin, non-fraying, and sticks to any clean dry surface. Bauer & Black, Industrial Adhesive Tape Dept. F., 222 W. Adams St., Chicago 6.

•

Pillow Block

Prelubricated sleeve-bearing pillow block, known as "Silent-Lign," employs an Oilite bearing enclosed in a bushing or shell of neoprene contained in a base of stamped, welded steel. The construction is said to reduce the transmission of noise as well as eliminate excessive wear, as it compensates for both parallel and angular misalignment. Bushings, Inc., Coolidge Highway at 14 Mile Rd., Royal Oak, Michigan.

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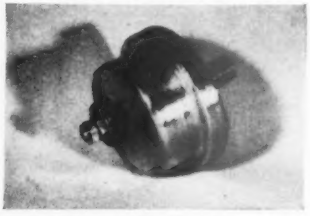


Diaphragm Pressure Switch

Designed to make or break contact at an accuracy of plus or minus one-quarter pound, diaphragm pressure switch will indicate pressures ranging from 10 to 25 pounds, but will withstand up to 300 pounds pressure without affecting the diaphragm, according to manufacturer. Made in two styles: single wire for grounded, or double for ungrounded circuits. Diaphragm is of beryllium copper sealed with an O-ring. Contact arms are of beryllium copper, have silver contacts. Device will carry up to 5 amperes at 12 volts a.c. or d.c. The Electric Auto-Lite Co., Industrial Instrument & Gage Div., Box 131, Toledo 1.

•

Ratchet Wrench

Heavy-duty reversible ratchet wrench, the Favorite Deluxe, is so constructed that total leverage from handle is applied to work, obviating danger of pawl breakage. Synthetic

when you want...

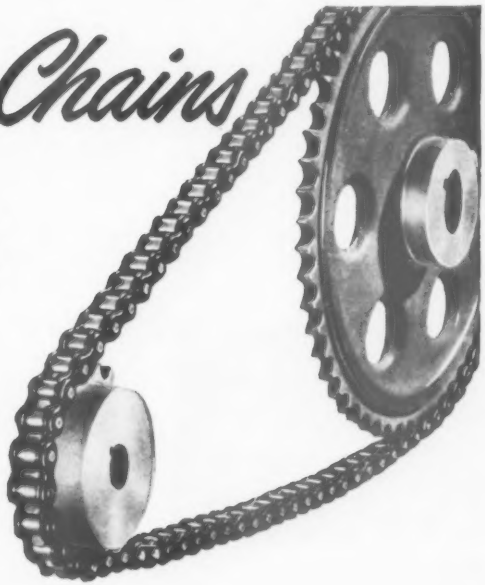
efficiency • Roller chain drives deliver 98% efficiency under all working loads. And this efficiency is not appreciably diminished throughout the lifetime of the drive. Properly applied, a chain drive has a higher sustained efficiency than any other mechanical power transmission medium.

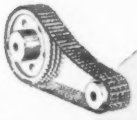
compactness • Roller chain drives combine light weight flexibility, and narrow width. Thus, they can be installed in very limited space. Center distances can be varied as desired to permit the most compact arrangement. Roller chain drives require less space per H.P. transmitted.

versatility • Roller chains have no "wrong side." They make proper contact with sprocket teeth on either side and can be used to drive multiple shafts from a single power source . . . are equally efficient on long or short centers. They can operate efficiently in conditions of dust, dirt, grease, oil and water . . . you need no special chains to overcome each of these conditions.

rely on Roller Chains

For all the facts on roller chains and how they can help you, see your Baldwin-Rex Distributor or write Baldwin-Duckworth Division of Chain Belt Company, 327 Plainfield Street, Springfield 2, Mass.





BALDWIN·REX ROLLER CHAINS

a complete line from ¼-inch to 2½-inch pitch

BALDWIN-DUCKWORTH DIVISION OF CHAIN BELT COMPANY

rubber ring retains socket in position. While the ring cannot come loose in use, according to manufacturer, it may be snapped on or off without special tools for interchange of heads. Double-head construction permits each head to have two sizes of opening, each accommodating a different size nut. Positive straight-ahead ratchet movement is said to eliminate lift-off at quarter turns, to permit operation in close quarters; free opening through the head socket permits use over long studs. Available with 15-, 24-, and 27-in. handles, sockets to accommodate from ¼- to 1½-in. nuts. Greene, Tweed & Co., North Wales, Pa.

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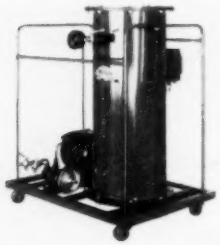

Paint Heater, Recirculator

Named Vicon, paint heating and recirculating system is said to maintain uniform viscosity of all types of paint materials by constant temperature control. Designed for use with spray painting systems, and may be installed between the pressure material tank or gravity feed system and the spray gun. Will heat material to any predetermined temperature between 100 and 200 degrees F. Constant recirculation through hose is said to prevent variable heat loss. Unit is mounted on a caster base; motor is explosion-proof, and all wiring, switches, and controls are vapor-proof. Industrial Sales Co. of California, 455 S. Fair Oaks Ave., Pasadena, Calif.

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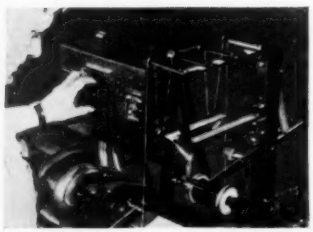

Speed Control

Continuously variable motor speed control, Type 1700-A Variac, is a low-power single-unit device for operating a 1/3-hp. d.c. shunt motor from an a.c. line. Constant field voltage is supplied by a dry-disk rectifier; armature voltage can be varied by autotransformer feeding electronic rectifier. Manufacturer states that regulation in rpm. is constant at all speed settings and is adequate for most applications. Both control and manual start-stop-reverse switch are housed in a 9x12x4½-in box. Dynamic braking is provided in the stop position; field voltage can be adjusted in steps to change maximum speed. Available in 115- and 230-volt models. General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

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Pneumatic Screwdriver

Designed for use where it is necessary to drive many small screws or other fasteners, small-size pneumatic reversible screwdriver weighs only 9½ ounces. Balanced-impact mechanism is said to absorb the driving torque, permitting finger-tip operation and control, eliminating twisting, and keeping tool from jumping out of the slot. Throttle valve is opened by pressure on the bit, and external adjustments for power and reversing make disassembly of the tool unnecessary. Cleco Div., Reed RollerBit Co., Box 2119, Houston 1, Texas.

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Work Gloves

Made of fabric and coated with Vinylite resins, work gloves are said to permit complete freedom of action and allow handling of wet or dry, sharp or abrasive materials. Manufacturer claims they also offer protection against acids, caustics, oils, greases, and many solvents. Edmont Mfg. Co., Coshocton, O.

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Circuit Protector

Pushmatic automatic protection for electrical circuits has no intermediate position, eliminating manual resetting. Fingertip control makes or breaks the circuit, or restores the flow of power when the circuit has been broken. Individual single-pole unit; available in four types: thermal only, thermal magnetic, or both of these with ambient compensation; all interchangeable for rating and type. Bulldog Electric Products Co., Box 177, Roosevelt Park Annex, Detroit 32.

•

Hot-Hose Hand Grip

Designed to act as hand-grip insulation on hot water or steam hose lines, device, called Kool-Grip, fits around the hose near the nozzle end. Outside covering is of molded rubber, with nonskid surface secured to a metal base crimped to hold it away from the hose and provide air space. Clamps on with four screws. Adaptors for all standard sizes. Duffy Industries, 536 S. E. 6th Ave., Portland 14, Ore.

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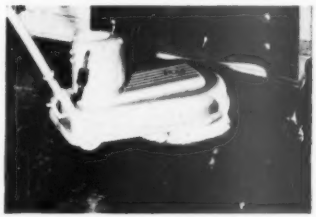

Floor Machine

All-purpose floor maintenance machine, No. 713, for use in small areas, has a 13-in. brush, is six inches high. It scrubs wet, dry, or with steel wool, applies seal, light-sands, applies wax, polishes, and shampoos rugs. Divided weight type construction; equipped with 1/3-hp. vertically mounted motor. Finnell System, Inc., Elkhart, Ind.

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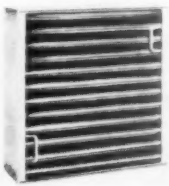

Air-Recovery Unit

Self-contained cell-type unit for removing odors from air conditioning and ventilating systems, known as Dorex Type C, has a capacity of 1000 cubic feet of air per minute. Its over-all dimensions are 24x24x8¾ inches. Manufacturer states that the

You don't need a buyer's market to cut this high cost! You can act NOW!

Your other high costs may or may not be "leveling off" but high eye accident costs are a tax no management need put up with.

Eyes are COSTLY targets when hit by particles that injure and blind. The average cost of a minor eye accident is over seven times the average cost of the goggle that would have prevented the injury. The ECONOMY of this protection is self-evident when it is realized that the cost of the goggle represents far less than two hours lost in productive time of the worker.*

Ask your nearest AO Safety Products Representative to show you how an adequate eye protection program *works* and how much it *saves!*

*Average price of goggles $2.30. Estimated 1949 average hourly earnings of factory workers $1.41 (Source: U.S. News)

American Optical COMPANY *Safety Products Division*

Southbridge, Massachusetts
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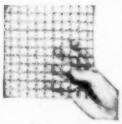
INDUSTRIAL WIRE CLOTH OR SCREEN

...from 4" opening to 20x250 mesh

Whether you need material for filtration, screening or fabrication, Cambridge offers you one complete source for any type of wire cloth or metallic screen. Skilled Cambridge craftsmen produce your material from any gauge metal or alloy, to the particular mesh or weave that best suits your requirements.

Call in your Cambridge Field Engineer whenever you need industrial wire cloth. He can offer you *fast delivery on stock or specially woven items.*



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Cambridge Wire Cloth Co.

Dept. E • Cambridge 7, Md.

trays • crates • screens
baskets • fixtures

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

"accordion pleat" construction of the perforated filter element provides a 28-sq.-ft. filter face area in a space of less than three cubic feet. Unit may be installed in multiple, in either flat or "V" arrangement. For abnormal odor concentrations, manufacturer recommends two cells in series per 1000 cfm. W. B. Connor Engineering Corp., 112 E. 32nd St., New York 16.

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Luminaire

Called Mazelite, luminaire features turret sockets to facilitate lamp changes, hinged reflector that opens on either side or is completely removable for cleaning. All-metal construction, without latches, springs, clips, or nuts, finished in 300-deg. metallic gray Permalux with 300-deg. white reflectors. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo.

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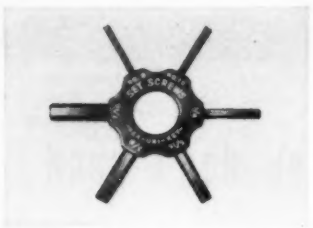

Multiple Socket Wrench

Designed to solve the problems of finding the right hex set screw wrench at the right time, compact tool, pocket-size, consists of six sizes of set screw wrenches anchored in a cast holder. Anchoring is done by a deforming process said to give good leverage without twisting or loosening. Device handles all types of socket, set, or cap screws; size marked on each side of holder. Eklind Tool & Mfg. Co., 2627 N. Western Avenue, Chicago 47.

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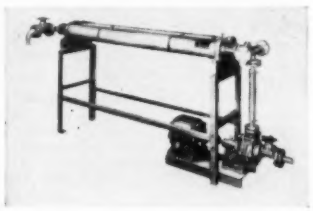

Electroplating-Solution Heat Exchangers

Design and construction of line of unit heat exchangers permits the use of the same unit for either heating or cooling plating solutions. Pure nickel tubes are used for nickel solutions, steel and special alloy for others. Units can be furnished with a combination of from one to six tubes in multiple for a variety of capacities, with special units available to meet unusual capacity or space requirements. May be obtained complete with pump and stand for setting on the floor, or the tubes alone may be obtained separately for wall or ceiling mounting. Industrial Filter & Pump Mfg. Co., 1621-39 W. Carroll Ave., Chicago 12.

•

Vertical Sander

Lightweight vertical sander, Model 7025, has an all-magnesium housing, weighs five pounds without sanding pad. Height to end of spindle is 8½ inches. Speeds can be adjusted by throttle control to 5000 rpm. Furnished with a choice of 7-in. backing pad, 4-in. cup grinding wheel with guard, or 4-in. wire brush. The Aro Equipment Corp., Bryan, Ohio.

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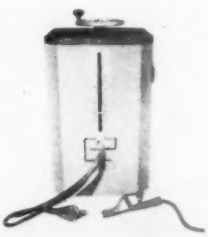


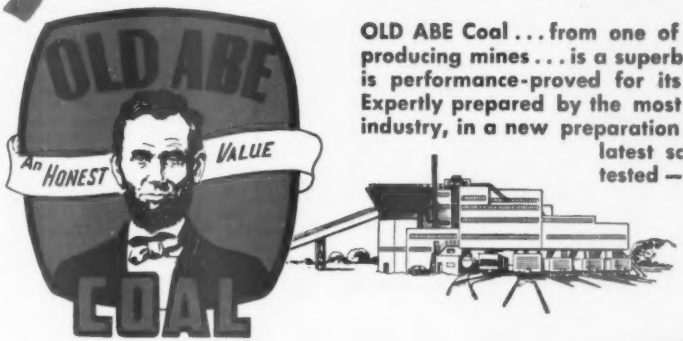
A.C. Welder

Developed to make possible the welding of light as well as heavy gage metals with one machine, double-duty welder, called the Eutecarc a.c. Welder, features a stepless heat control for adjustment of current. Manufacturer claims operating adjustments are simple and small diameter electrodes may be used without waste or damage. Mounted on casters in a drip-proof case; over-all dimensions, 17x17x32 inches. Machine will accommodate

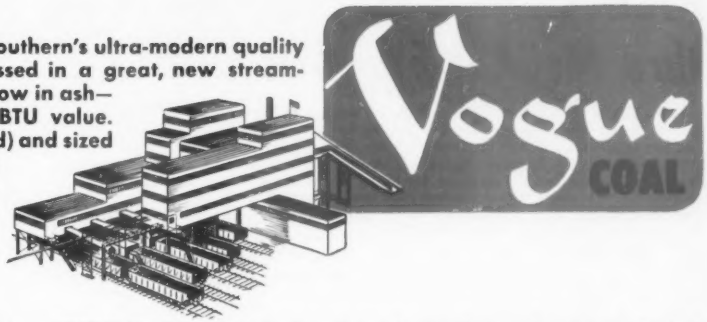
First Choice of Industry

because of Improved Preparation!

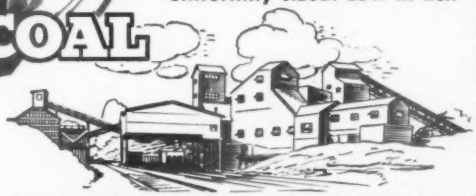
OLD ABE Coal . . . from one of America's newest and largest producing mines . . . is a superb stoker and industrial coal that is performance-proved for its clean, free-burning qualities. Expertly prepared by the most modern methods known to the industry, in a new preparation plant fully equipped with the latest scientific machinery. Laboratory tested — thoroughly washed — sized to your needs — oil treated (if desired).



VOGUE Coal is another of Southern's ultra-modern quality coals, that is specially processed in a great, new streamlined preparation plant. It's low in ash—free-burning—and high in BTU value. Washed, oil treated (if desired) and sized to a maximum degree of uniformity for ideal stoker and industrial use.



SKIBO Coal is the latest and most popular coal ever marketed by the producer during 50 years of successful operation. It meets industry's demands for quality and unvarying efficiency. Skilled mining engineers and laboratory technicians assure uniform production day after day. Thoroughly cleaned in one of the most modern washers obtainable — oil treated (if desired), uniformly sized. Low in ash — high in BTU value.



These three great premium industrial coals from Western Kentucky are ready for immediate shipment. Tremendous production and extensive reserves assure dependable delivery for years to come.

Southern's 53 years of experience and staff of Combustion Engineers are ready to help you solve your particular boiler room problems. Telephone, write or wire and a Southern representative will call.

SPONSORING MEMBER COAL HEATING SERVICE NATIONAL COAL ASSOCIATION

SOUTHERN COAL COMPANY INC AVS-2

Southern Coal Company, Inc.

Atlanta Birmingham Charlotte Chicago Knoxville
Louisville Memphis Nashville New Orleans St. Louis
In Canada—Boon-Strachan Coal Co., Ltd., Montreal

Production Delays? Cut them thru McCASKEY TOOL CONTROL

One cause of rising production costs can be stopped at the tool crib by McCaskey Control. Delays or slow service caused by missing tools are expensive. They hold up jobs and pile up idle time for both men and machines. Most of them are unnecessary.

The Van Norman Company, Springfield, Mass., shared its procedure for stopping them with the readers of "American Machinist," in a recent article by Mr. Mitchell Mastalerz. Their production of machine tool and automotive equipment requires three cribs in which the widest diversity of demands are met. The following abstracts indicate how McCaskey Tool Control has assisted them:

OBJECTIVES

1. Least possible loss of productive time for men and machines.
2. Advance planning & preparation of tools to reduce set-up time where as many as 40 tools are required.
3. Their delivery to machines in maximum of 1-hr.
4. Essential tool crib records, accurate and up-to-the-minute.

ACCOMPLISHMENTS

1. Tools from 2 cribs issued in carefully engineered and permanently recorded kits; individually issued from their crib.
2. Kits designated by parts and operation number issued on one tool loan order by number with copy of tool list.
3. Special procedure for kits including expensive carbide tools and cutters provides for their use on several operations.
4. Previous experience: 60 delays in a day from tool shortages. Current performance: only 2 or 3, most of them unavoidable, rarely from failure of scheduling or tool service.
5. Lost time at machines decreased; overall efficiency of Operating Department increased.
6. Tool cribs now are giving faster, better tool service, serving the same number of employees and comparable production at less cost and with fewer crib attendants than required by old check system.

Write today for "Tool Kits Cut Costs" by Mr. Mastalerz from which these facts are taken and similar reports from several other well-known plants. Or, let us have a representative explain without obligation how McCaskey will help you cut your tool expense.

McCaskey INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • COSTS • PAYROLL

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Canada — The McCaskey Register Co., Watford, England

electrodes from 1/16th to ¼-in. diameter; available for 220- or 440-volt service. Eutectic Welding Alloys Corp., 40 Worth St., New York 13.

•

Lubricator

Automatic lubricator for both trolley wheel bearings and pins on manufacturer's twin T-rail-type conveyor operates through a core oven. It lubricates both bearings at the hubs on inside and outside of the wheels. Both lubricator and a 2-gal. oil reservoir are located 8 inches above the bearings. As each pair of trolley wheels passes the lubricator, wheels trip triggers which automatically release jets of oil-fogged air directly into the bearings, coating them with oil film. Air pressure, volume of atomized lubricant, direction, and timing are all adjustable. J. N. Fauver Co., 49 W. Hancock, Detroit 1.

•

Pump

"Sliding" vane-type rotary pump, designed to handle viscous liquids up to 100,000 SSU, is constructed with the vanes actuated by push rods through the rotor and shaft. Can be furnished in sound-deadening, nonmetallic material said to reduce noise and increase wear resistance. Vanes are replaceable without disturbing piping or drive, according to manufacturer. Blackmer Pump Co., Grand Rapids, Mich.

•

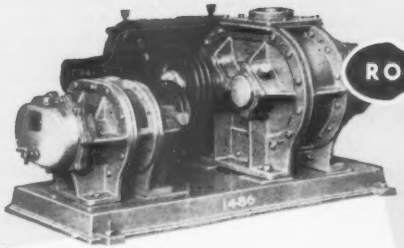
Drum Wrench

Designed to open oil drums, wrench has a 16-in. handle which clears the rim of the barrel, allowing operator to get a full hand grip. Made from 41-40 steel or equivalent, wrench is heat treated and cadmium plated, weighs two pounds. A separate seal breaker for cutting metal covers on barrel plugs fits in the head of the wrench. Lewis L. Busby, 2428 Plum St., Everett, Wash.

•

Jointer

Dual-purpose guard of 6-in. jointer enables operator to plane stock ribbon thin, or in narrow strips, and to rabbet up to ½ inch deep, according to maker. One lever locks both tilt and lateral movement, and rear knife guard keeps knives always covered, regardless of position of fence. Three-knife, 2½-in.-diameter cutter



R-C Blower and Gas Booster mounted on same bedplate, with V-belt drives from 5 HP motor. Capacity, 125 CFM.

ONLY

R-C dual-ability

GIVES YOU

dual choice

R-C Centrifugal Blower —24" type OIB, driven by 250 HP motor. Capacity, 15,220 CFM.

When it comes to choosing between Centrifugal and Rotary Positive Blowers and Exhausters, you'll get impartial suggestions from R-C *dual-ability*. That's because we build both —and we are the only blower manufacturer who gives you the benefit of this *dual choice*.

Another advantage of consulting us results from our wide range of units of both types. If it's 10 CFM you need, we'll supply it. Or, if your use calls for extremely large volume, we build them to any desired size.

One more point—air or gas handling equipment is our "bread and butter" . . . we have no other business. That means detailed and *interested* attention to your requirements from an organization that has specialized on that job for almost a century.

ROOTS-CONNERSVILLE BLOWER CORPORATION
907 Central Avenue, Connersville, Indiana

FOR HANDLING GAS OR AIR, CALL ON *R-C dual-ability*

Roots-Connersville builds the most extensive line of gas or air handling equipment.

Centrifugal and Rotary Positive Blowers, Exhausters, Boosters

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Rotary Liquid and Vacuum Pumps

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Send for descriptive bulletins or write us details of your specific requirements.

★ ★ ★ ★ **ROOTS-CONNERSVILLE** BLOWER BUILDERS R-C SINCE 1854 ★ ★ ★ ★

BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

ONE OF THE DRESSER INDUSTRIES

LONGER LIFE

FOR BALL AND ROLLER BEARINGS

Your investment in anti-friction bearings is certainly great enough to warrant your investigating the possible savings to be made through the use of LUBRIPLATE lubricants. They actually preserve bearing surfaces, arrest progressive wear and protect against rust and corrosion. There are LUBRIPLATE lubricants for all speeds, all operating temperatures and conditions. Write for particulars.

Rx FOR YOUR MACHINERY

No. 2 — Ideal for general oil type lubrication, ring oiled bearings, wick feeds, sight feeds and bottle oilers.

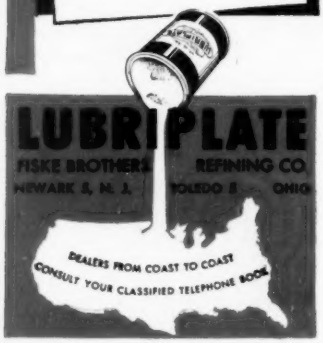
No. 8 — Because of high film strength and long life it reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107 — One of the most popular grease type products for general application by pressure gun or cups.

No. 70 — For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA — Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING — This is the LUBRIPLATE Lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.


LUBRIPLATE
FISKE BROTHERS REFINING CO.
NEWARK 5, N. J. TOLEDO 5 OHIO
DEALERS FROM COAST TO COAST
CONSULT YOUR CLASSIFIED TELEPHONE BOOK

head is of solid steel, ground and dynamically balanced. Height from floor to table is 34½ inches, length, 42½ inches. Available with triple-belt drive and direct-mount motor bracket or with flat-type conventional guard, single-belt drive. Walker-Turner Div., Kearney & Trecker Corp., Plainfield, N. J.

•

Guard Rail

Designed for use at points of most frequent derailment, "Biggie" guard rail combines a re-railer and splice bar; can be attached in 30 seconds, according to manufacturer. It is made from one piece of alloy steel for continuous or intermittent duty at frogs, switches, and short turns; construction is said to prevent turning over or twisting out. Mining Machine Parts, Inc., 5707 St. Clair Ave., Cleveland.

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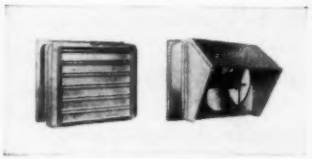


Outside Window Fan

Belt-driven fan for mounting on outside window frame is available with either hood or automatic shutter. Equipped with cord and plug and pull-chain switch, available in two sizes: 24-in. model, with an air output of 4500 cfm., ¼-hp. motor and single-fan speed of 620 rpm.; 30-in. model, 6500 cfm. air delivery, ¼-hp. motor, and single-fan speed of 500 rpm. For larger air delivery, model AP3OH is available with ½-hp. motor, fan speed of 620, 8200 cfm capacity. Chelsea Fan & Blower Co., Inc., 1206 Grove St., Irvington, N. J.

•

Lubricator

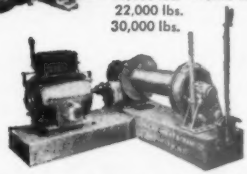
Automatic lubricating device, called Electro-Oiler, releases oil from a reservoir by a solenoid-operated valve through single or multiple sight-feel valves to a number of individual bearings. The solenoid is connected across the line of the driving motor of the machine to be lubricated. As soon as the motor switch is turned on, lubrication starts.

CAR PULLERS, BARGE MOVERS
ELECTRIC, GASOLINE, DIESEL

Let *Silent Hoist* Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications—rigging, skip hoists, maintenance, construction, cable ways, etc.

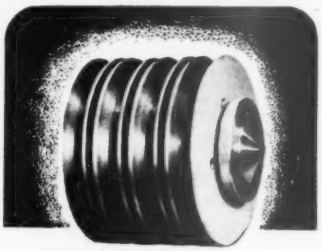
CAPSTAN DRUM WINCH

6 Sizes: Draw Bar Pull Capacities	4 Sizes:
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of KRANE KAR Swing-Boom Mobile Cranes, LIFT-O-KRANE Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.

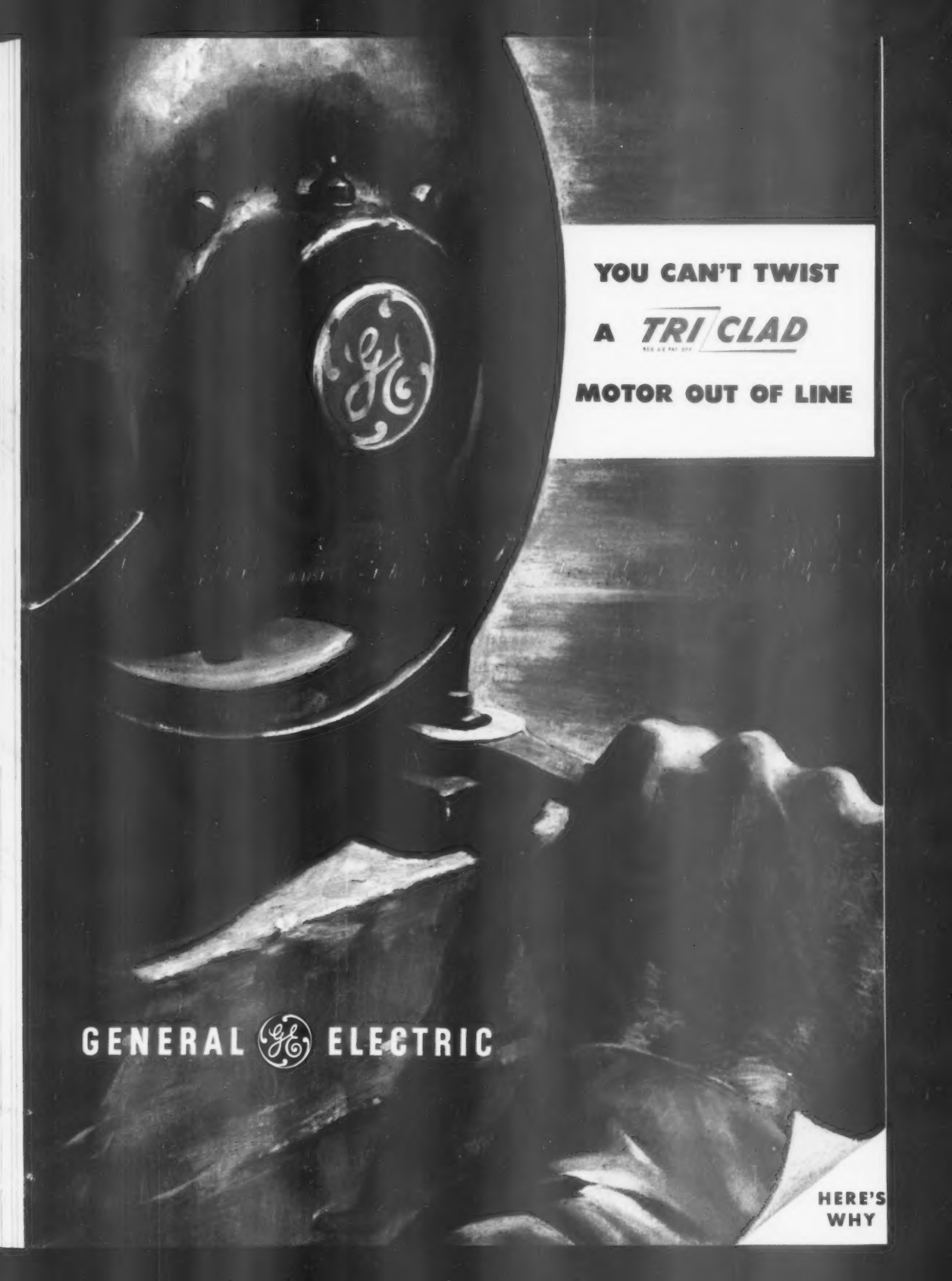
THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
855 63rd ST., BROOKLYN 20, NEW YORK

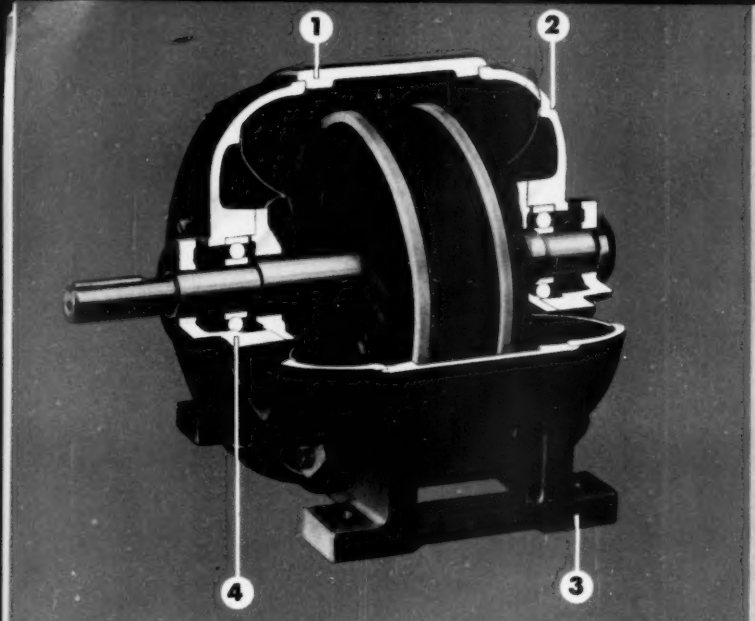


BELT MAXI V PICH SHEAVES

"V-Belt" Maxi-Pich Sheaves increase production capacity and lower production costs. Two inch pitch variation; constant belt alignment and standard companion sheaves save installation and operating costs; interchangeable hubs for different drive shaft sizes. Write today for catalog and name of nearest dealer.

V-BELT ENGINEERING COMPANY
Richmond, Virginia


YOU CAN'T TWIST
A TRI CLAD
MOTOR OUT OF LINE
GENERAL ELECTRIC
HERE'S
WHY



Look at the solidity of a Tri-Clad's thick-section cast-iron frame (1) and heavily reinforced end shields (2) . . . its heavy integrally cast feet (3). Do you wonder we say "Tri-Clad gives you structural strength and rigidity no other general purpose motor can match"? Notice, too, the *completely enclosed* bearings (4). A Tri-Clad motor will run safely without relubrication for years — as long as any general-purpose motor you can buy. Yet it's grease-gun easy to lubricate if you ever need to.

You can't twist a *TRI CLAD* motor out of line

Try as a heavy-muscled mechanic may, he can't twist a Tri-Clad motor frame when bolting it to an uneven surface. The bolt will snap before he can pull that rigid cast-iron structure out of line.

Important? It's one of the basic reasons General Electric believes cast iron to be the ideal structure for general-purpose industrial motors. Other reasons? Cast iron has unusually high resistance to rust and corrosion. It has an inherent damping action that minimizes resonance. And . . . it won't take on an injurious permanent "set" as a result of accidental blows or mechanical abuse.

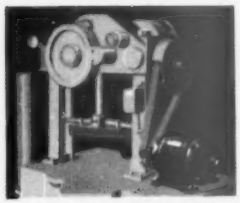
Want a motor that's been **SERVICE-PROVED** in 5 billion hours of rugged industrial use? Nearly all types and ratings are **AVAILABLE FROM STOCK.**

Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

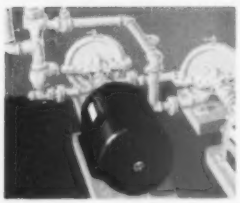
GENERAL ELECTRIC

760-19

YOU CAN'T BEAT *TRI CLAD* EXTRA PROTECTION

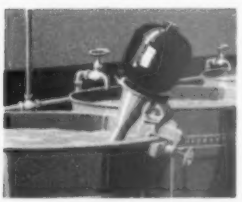


G-E open (drippproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.

G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 75 hp.



G-E flange and face-type motors for use where the machine supports the motor, or vice versa. From 1/20 to 60 hp.

Look for this **EXTRA** on the motor you buy!

Manufacturer states that single reservoir will feed up to 24 bearings. Adjustments on each feed valve can be made and retained through the use of a friction screw which can be locked against severe vibration. Suitable for use on machine tools, presses, conveyors, and similar equipment. Oil-Rite Corp., 3479 S. 13th St., Milwaukee 7.

•

Current-Measuring Instrument

A.c. clamp ammeter and voltmeter has five current ranges up to 1000 amperes, and three voltage ranges up to 700 volts. Known as Model 633 Type VA-1, it is designed to measure alternating currents and voltages without interrupting electrical service. Jaws, which will accommodate conductors, bare or insulated, up to two inches in diameter, are insulated with rubber sleeves. Weston Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.

•

Heavy-Duty Casters

Line of forged steel heavy-duty casters in 5-, 6-, and 8-in.-diameter wheel sizes uses high-quality unit-type enclosed main load bearings and Timken thrust bearings, with forged steel frame and top plate. Suitable for operating loads of 1500 to 2000 pounds per caster. The Bassick Co., Bridgeport, Conn.

•

Phosphorescent Signs

Series of "Exit" and "Fire Escape" sign boxes makes use of phosphorescence, which is said to keep the signs glowing long after other light sources are gone. They may be installed without separate service, and in many localities may be wired to present

BECAUSE THEY ARE QUIET and fume-free, battery industrial trucks can be used in virtually any part of the plant. They can even be provided with spark-enclosed construction if fire and explosion hazards exist.

They use low-cost electric power and use it with peak efficiency . . . starting instantly, consuming no power during stops. Their electric motors have few wearing parts; are easy to maintain; rarely need repairs. Thus they have inherent economy and dependability.

They are doubly dependable and economical when powered by EDISON Nickel-Iron-Alkaline Storage Batteries. These are the longest-lived and most durable of all batteries, with steel cell construction, electrolyte which is a preservative of steel, and a foolproof principle of operation.

If you do not already use EDISON, get a current price quotation —you will probably find initial cost *much lower* than you think. Couple this factor with well-known EDISON long life and you will have the key to year-after-year economy.

ADVANTAGES OF EDISON NICKEL-IRON-ALKALINE BATTERIES: They're mechanically durable; electrically foolproof; quickly and easily charged; simple to maintain; not injured by standing idle.

EDISON
Nickel • Iron • Alkaline
STORAGE BATTERIES

EDISON STORAGE BATTERY DIVISION
of Thomas A. Edison, Incorporated, West Orange, N. J.
In Canada: International Equipment Co., Ltd., Montreal and Toronto

Greater Service to Fork-Truck Users

Greater Opportunities for Men Who Sell Them —

Clark Dealer Plan Achieves **Both**

WITH sales of its fork-lift trucks and industrial towing tractors exceeding all expectations, and with its position of production and engineering leadership firmly rooted in rich, productive soil, Clark Equipment Company, in its 30th year as a builder of materials-handling machines, has found it desirable to establish a nation-wide organization of independent franchised dealers as exclusive distributors of the products of its Industrial Truck Division.

THIS is indeed a far cry from 1939 when the entire output of the Industrial Truck Division was sold with ease by a handful of men!

TODAY'S volume is twenty times that of 1939; and the Company's stature—financial and engineering—is more than twenty times as great as in 1939. A considerable number of the '39 machines are in daily service, and many older machines are in regular operation after 20 and 25 years. The conviction is natural that 30 years hence many '49 machines will still be "on the job" alongside the new output of 1979. There will be no "orphans" bearing the name "Clark."

TO KEEP PACE with increasing demands, and to deliver the broad and competent service which Industry expects from Clark, the Company has chosen this plan of selling through independent dealers as a sound and logical evolution. Until the middle of 1948, approximately one-third of Clark's Industrial Truck Division representatives were on an independent dealer basis. It is expected that by the end of 1949 the nation-wide dealer organization will be complete.

HEADING up the dealerships or actively participating in them are key men of Clark's erstwhile factory-branch sales offices —factory-trained men, tested and proved as capable materials-handling counselors. These men share with Clark management the conviction that they can deliver, under the new plan, a broader and more valuable service to their customers and to all users of mechanized materials-handling; that they face broader, deeper vistas of opportunities which ambitious men so earnestly desire—opportunities for independence, for building greater earnings by their own efforts, for achieving prestige and leadership in their communities.

ANOTHER influence which furthered the plan is the fact that Clark management historically has been engineers and manufacturers. By decentralizing marketing activities, Clark can intensify its emphasis on development of better materials-handling machines and methods—to the end that Clark products shall achieve even higher excellence at lower cost, shall become still more valuable to industrial users and to the dealers who serve them.

THROUGH your Clark dealer, all the advantages of Clark engineering, integrated production and matchless experience are quickly available to you. He is fully qualified to make an unbiased appraisal of your materials-handling operations, and to recommend the type of machine that will serve you most efficiently at lowest cost. It's "good business" to CONSULT CLARK.

CLARK EQUIPMENT COMPANY

INDUSTRIAL TRUCK DIVISION

BATTLE CREEK 12, MICHIGAN

OTHER PLANTS—BUCHANAN • JACKSON • BERRIEN SPRINGS, MICHIGAN

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

AUTHORIZED CLARK DEALERS

ALABAMA: BIRMINGHAM
*M-H EQUIPMENT COMPANY
845 LOMB AVENUE

ARIZONA: PHOENIX
ROBERT H. BRAUN COMPANY
743 GRAND AVENUE

ARKANSAS: LITTLE ROCK
FRED J. VANDEMARK COMPANY
209 EAST MARKAM STREET

CALIFORNIA: FRESNO 1
ROBERT H. BRAUN COMPANY
505 MASON BUILDING

LOS ANGELES 23
*ROBERT H. BRAUN COMPANY
3008 EAST OLYMPIC BLVD.

OAKLAND 3
*GLEN L. CODMAN COMPANY
10521 PEARMAIN STREET

SAN DIEGO
ROBERT H. BRAUN COMPANY
3872 FIFTH AVENUE

STOCKTON
GLEN L. CODMAN COMPANY
409 BELDING BUILDING

COLORADO: DENVER 2
*J. N. MEADE
420 U. S. NATIONAL BANK
Service: FORK LIFT TRUCK SERVICE
2855 WEST 8TH AVENUE

CONNECTICUT: NEW HAVEN
*C. E. REUTTER CORPORATION
66 AMITY ROAD

FLORIDA: TAMPA
CLARK EQUIPMENT COMPANY
1145 ELIZAMAE STREET

ILLINOIS: CHICAGO 4
*MODERN HANDLING EQUIP., INC.
310 SOUTH MICHIGAN AVENUE
(Service: Cook County)
LIFT TRUCK SERVICE COMPANY
6919 SOUTH HALSTED STREET

INDIANA: INDIANAPOLIS 5
*W. A. MARSCHKE & SONS
1121 E. 46TH STREET

SOUTH BEND 14
*MATERIALS HANDLING EQUIP. CO. OF SOUTH BEND, IND.
2625 SOUTH MICHIGAN STREET

IOWA: DAVENPORT
*BIG RIVER EQUIPMENT CO.
1344 WEST THIRD STREET

DES MOINES
*BIG RIVER EQUIPMENT CO.
914 GRAND AVENUE, ROOM 255

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T. G. FRAZEE
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(CONTACT MALDEN, MASS.)

MARYLAND: BALTIMORE
FALLSWAY SPRING & EQUIPMENT CO.
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MASSACHUSETTS: BOSTON (MALDEN 48)
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MICHIGAN: BATTLE CREEK
CLARK EQUIPMENT COMPANY
INDUSTRIAL TRUCK DIV. PLANT

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Service: INDUSTRIAL TRUCK SERVICE, INC.
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MINNESOTA: MINNEAPOLIS 2
*MATERIAL HANDLING ENGINEERS
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Service: SMITH-DUNN COMPANY, INC.
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MISSOURI: KANSAS CITY 6
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Service:
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NEW YORK 14 NEW YORK

NEW YORK: BUFFALO
*BRODIE INDUSTRIAL TRUCKS INC.
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NEW YORK 6
*BOND INDUSTRIAL EQUIPMENT CO.
165 BROADWAY, ROOM 2200 (OFFICE)
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289 BOND STREET, BROOKLYN 31
SYRACUSE
BRODIE INDUSTRIAL TRUCKS INC.
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*INDUSTRIAL TRUCK SALES, INC.
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TOLEDO 10
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ARST EQUIPMENT COMPANY
34 NORTH MADISON

OREGON: EUGENE
PRESTON FALLER COMPANY
891 TAYLOR STREET
PORTLAND 5
PRESTON FALLER COMPANY
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PENNSYLVANIA: PHILADELPHIA 8
*CLARK EQUIPMENT COMPANY
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Service: LIFT TRUCK SERVICE CO.
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CLARK EQUIPMENT COMPANY
927 15TH STREET N. W.

TERRITORY OF HAWAII: HONOLULU
*PRESSED STEEL CAR COMPANY
538 REED LANE, P. O. BOX 300

*Sales and Service.

For Names and Addresses of Export Distributors, write to: Export Division, Clark Equipment Co., Battle Creek, Mich., U.S.A.

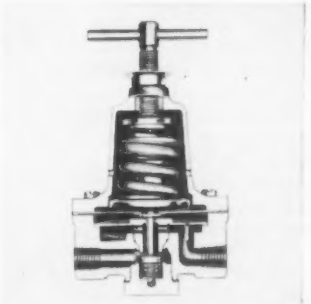
systems. All American Products, Dept. 10, 141 W. Jackson Blvd., Chicago.

•

Apron or Slat Conveyors

Heavy-duty conveyors of the apron or slat type are available with wood or steel slats. They are adapted to movement of nonrigid objects such as bags or bails, as well as unusual-shaped products which must be handled at extreme temperatures. Made to order in various widths and lengths, and equipped with heavy-duty electric motors with variable speed devices. Sage Equipment Co., 30 Essex St., Buffalo 13, N. Y.

•



Pressure Regulator

Protection against "creep" is one of the features of relieving-type pressure regulator designed for use on lines carrying oil or noncorrosive gases and fluids. Suitable for line pressures up to 400 psi. and working pressures up to 250 psi., relief valve is constructed so that the lower spring rest, containing the valve opening, pivots on a ball-end valve pin. This is said to permit downward adjustment of pressure without "bleeding" the line and to safeguard against damage to parts due to pressure surges. C. A. Norgren Co., 222 Santa Fe Dr., Denver.

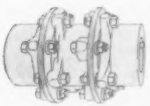
•

Heavy-Duty Mounting Chassis

Self-propelled mounting for cranes from 10- to 25-ton capacity obtains its propulsion power through the travel clutches and vertical shaft of the crane itself. Called the Krane Carriage, it is equipped with a 4-speed transmission ranging from 2 to 10 mph. in either direction. Manu-

THOMAS
Flexible ALL METAL COUPLINGS

Engineered to stand up on the toughest jobs, Thomas Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.



The standard line of Thomas Couplings meets practically all requirements. But if unusual conditions exist we are equipped to engineer and build special couplings.

BACKLASH FRICTION WEAR and CROSS-PULL are eliminated NO LUBRICATION REQUIRED!

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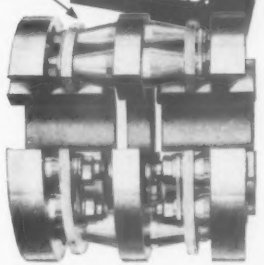

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WARREN, PENNSYLVANIA

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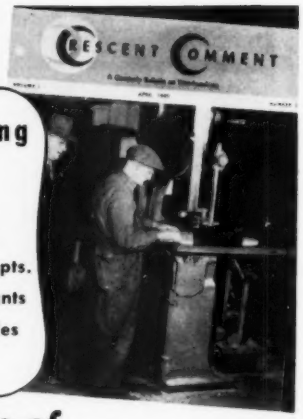
- Maintenance Depts.
- Cabinet Shops
- Sash & Door Plants
- Shipping Depts.
- Furniture Factories
- All Woodworking Plants



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CW-34C

facturer states that there is complete control of the entire machine from operator's seat in the cab regardless of its position on the mounting. Units are available as original equipment or may be obtained to convert crawler or rail-type cranes to rubber tired mountings. Keystone Driller Co., 419 Wood St., Pittsburgh 22.

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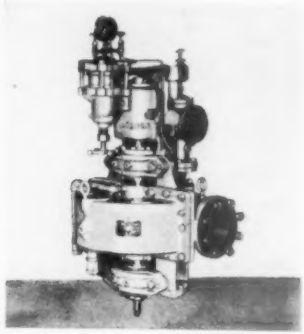

Vertical Turbine

Small vertical steam turbine, capable of developing ratings up to 90 bhp., is available in either semi-steel or cast-steel to meet varying steam pressures and temperatures. The standard unit can take thrust loads in either direction up to approximately 1500 pounds and can be changed to take even higher loads, according to maker. It is equipped with both constant speed and emergency governors. Pump governors can be built in. Whiton Machine Co., New London, Conn.

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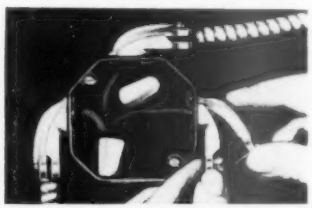


Connectors

Called the Harbot, $\frac{3}{8}$-in. connectors for attaching armored cable to knockout boxes in electrical installations form a rigid fitting which protects wiring from damage at the point of entry. They are suitable for use in installations where severe vibrations exist. Made of aluminum die-cast alloy, device may be installed from outside of the box after the wiring hook-up is completed, according to manufacturer, and the cable-connector assembly positioned in any direction. Unimatic Corp., 52 E. Centre St., Nutley, N. J.

•

Selenium Rectifiers

High-voltage selenium rectifier cells are designed for a d.c. voltage of 24 volts per cell, with an RMS a.c. voltage of 33 volts per cell for

COMPLETE *Finishing* SYSTEMS

for ENAMEL • LACQUER • PAINT

Exterior View of a Complete Mahon Finishing System Planned and Installed for the Coleman Company, Wichita, Kansas.

. . . an Investment in TOP EFFICIENCY and LOWER PRODUCTION COSTS!

Interior View on Ground Level Showing Mahon Hydro-Filter Spray Booths in Two Production Lines with Diffusers of Filtered Air Supply System Directly Above. Metal Cleaning and Rust Proofing, Spray Painting, and Dip Enameling Equipment are Located on the Ground Floor. The Filtered Air Supply System, Drying Ovens, Bake Ovens, Heating Units and Controls, and Recirculating and Exhaust Fans are located on the Second Floor Level.

Here, again, is a typical Mahon solution of a complex finishing problem...a complete self-housed finishing system planned from-the-ground-up, engineered and built by Mahon. A finishing system of this type, installed adjacent to manufacturing buildings, has many advantages . . . most important of which is freedom in planning, which results in 100% efficiency in production layout and equipment performance—all building restrictions and consequent compromises are eliminated, because the exterior housing is designed to fit the finishing system. The current trend in industry is toward this type of efficiently planned, self-housed finishing system to produce the finer sales-influencing finishes so important in marketing today. Where space adjacent to manufacturing buildings is not available, the complete system may be installed on the roof, in a court, or areaway. Remember, when you are contemplating new finishing equipment, that the Mahon organization has pioneered development in this highly specialized field for twenty-nine years . . . broad experience in every industry where finishing constitutes a major production operation, backed by constant research and experimentation, has endowed Mahon engineers with a wealth of technical knowledge and practical know-how not available to you elsewhere.

THE R. C. MAHON COMPANY

Home Office and plant, Detroit 11, Mich. • Western Sales Div., Chicago 4, Ill.

Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning and Rust Proofing Equipment, Dry-off Ovens, Hydro-Filter Spray Booths, Filtered Air Supply Systems, Drying and Baking Ovens, and Paint Reclamation Units. Also, Core Ovens, Hydro-Foam Dust Collectors, and many other Units of Special Production Equipment.

MAHON

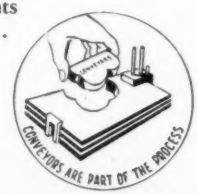
After packing on Roller Conveyor work table, Fluorescent lamp cartons move via Logan Belt Conveyor to stitching machines, storage. Declining belt (rear) lowers cartons from floor above.
GLASS

How Conveyors boost the speed of LIGHT

In this packing room of a well-known lamp company, Fluorescent tubes must be handled carefully yet swiftly to keep pace with production schedules.

Logan Conveyors proved to be the most satisfactory method because they virtually eliminated risky "man handling" . . . permitted packing room and shipping room operations to "flow" in time with production . . . and reduced costs right down the line.

Another result? On time shipments . . . fewer disappointed dealers . . . faster delivery of light to America's millions. Write for literature today.



Logan Conveyors

LOGAN CO., INC., 510 CABEL ST., LOUISVILLE, KY.

single-phase bridge circuits. They are available in six round sizes, from one to 4⅜ inches in diameter; also 5 inches square and 4¼x4-in. Westinghouse Electric Corp., Box 868, Pittsburgh 30.

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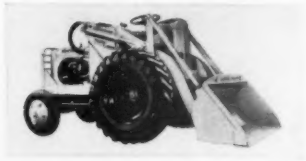

Loading Truck

Called the TL-W Tracto-Loader, materials handling truck has a ½-cu.-yd. bucket. It is mounted on rubber tires, with the bucket over the driving wheels, the steering wheels in the rear. Short over-all length, 12 feet with bucket down, and 5-ft.-9-in. width permits working in limited areas. Bucket is hydraulically operated, can be dumped in part or totally, and will fully load average dump truck, according to maker. Tractomotive Corp., Deerfield, Ill.

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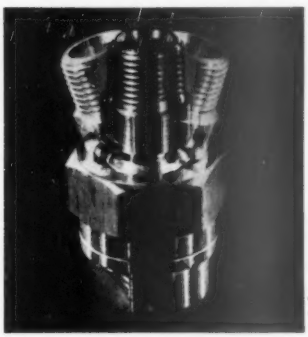


Swivel-Ball Joint Coupling

Universal swivel-ball joint coupling for pipe or hose, the Kelite, will turn 20 degrees in any direction with no restriction of flow, according to maker. It is claimed that it absorbs vibration and movement in installations where pipe cannot be rigidly supported. O-ring seal eliminates leakage and drip. Standard ⅜-in. unit is suitable for pressures from ¼ ounce to 150 pounds psi., and for temperatures up to 350 degrees F. Other models for any size pipe and for higher temperatures and pressures also available. Kelite Products, Inc., Box 2917 Terminal Annex, Los Angeles 54.

•

Rotameter

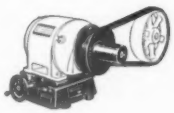
Full-view rotameter may be obtained with two or more rotameter tubes for use on related flows. Standard end fittings are fastened to metal back plate with dowel pins and cap screws; front is shielded by a ¼-in.-thick plastic window. Each tube with its fittings may be removed without disturbing any of the other parts.

Guess which twin has the
Reeves-equipped machine!

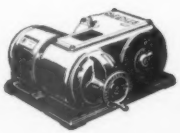
THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



There's not much profit in scrap! By installing 265,000 accurate, instantly and infinitely variable REEVES Speed Control units on machines in their plants, the managers of 25,000 industrial companies have insured uniformity of processing and production which keeps losses of time and material at a minimum. With the ability to adjust machine speeds at will for best results, operators and machines turn out more work, better work, at lower cost. Want to know more? Then ask without obligation, for a factory and field trained REEVES Speed Control Engineer to call, or send for Catalog F12-450A.

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Air Cylinders
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SOLID STEEL HEADS, CAPS, AND MOUNTINGS — MACHINED FROM SOLID BAR STOCK
HARD CHROME PLATED PISTON RODS
DIRT WIPER SEALS
No Broken Castings
No Scratch-Damage
to Piston Rods, Bushings
and Seals . . .
therefore . . .
NO COSTLY "DOWNTIME" - NO REPAIRS
NO MAINTENANCE - NO POWER WASTAGE

SOLID STEEL HEADS, CAPS, MOUNTINGS. Dependable protection against the breakage that commonly occurs in "cast" cylinders when subjected to heavy shock loads in normal operation and when subjected to eccentric loads developed by cylinder misalignment. Eliminate "porosity" of castings. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

HARD CHROME PLATED PISTON RODS. 90,000 to 110,000 psi yield point heat treated stress relieved steel accurately ground, polished, then *hard chrome plated.* Highly resistant to the nicks and scratches that commonly cause power wasting leakage. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

DIRT WIPER SEALS. Wipe piston rods clean on every "in" stroke, protecting piston rods, seals, and bushings from scratch-damage by dirt, scum, abrasive particles. Easily replaceable. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

Complete Line

- AIR CYLINDERS 1½" to 20" Bores
- LOW PRESSURE HYDRAULIC CYLINDERS 1½" to 12" Bores
- HIGH PRESSURE HYDRAULIC CYLINDERS 1½" to 12" Bores

Single and Double Acting, Single and Double Rod End, Spring Return, Cushioned and Non-Cushioned, Over-Sized Rod, and Long Stroke Cylinders in All Mounting Styles.

write for

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MILLER MOTOR COMPANY

4033 N. KEDZIE AVE. • CHICAGO 18, ILLINOIS

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS • COUNTERBALANCE CYLINDERS • BOOSTERS • AIR HOISTS

Suitable for service where two or more flows have a direct relationship to each other. The Brooks Rotameter Co., Lansdale, Pa.

•

Insecticide Spray

Automatic insecticide sprayer, called Mistorizer, operates on a.c. or d.c., requires no filters, oiling, or greasing, according to maker. It runs wet or dry, is said to be leakproof. West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y.

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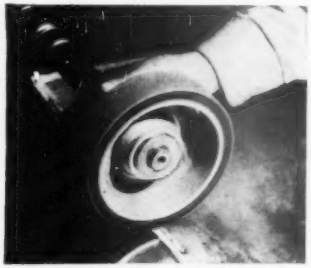

Drum Sander

Developed to permit use of standard strip abrasives, lightweight buffer drum sander, the Cone-Loc, is adaptable for use with flexible shaft or stationary arbor. It is a split drum, cushioned with rubber, locked together by a cone-type washer. Standard width abrasives in various grits, available in roll form, may be wrapped around the drum and secured by pins that recede when washer is tightened. During buffing, polishing, or grinding, the wheel will not lose diameter or need dressing, according to maker. Standard models available from 6¼ to 12 inches in diameter, various widths and bores. A 6¼-in. felt-cushioned sander is also available. American Diamond Saw Co., 519 N.W. Park Ave., Portland 9, Ore.

•

Submersible Pump

Built to deliver up to 700 gallons of water per minute from depths of 500 feet, turbine pump operates while both pump and motor are completely submerged, pushing rather than lifting the water. Unit is made up of a multi-stage centrifugal pump close-coupled to an electric motor; available in two types: high-pressure, closed-impeller type, for 6- and 8-in. diameter wells, and a higher-capacity open-impeller type for wells with a minimum diameter of 10

NEW . . . AO R2000 RESPIRATOR

WITH 7 TYPES OF CARTRIDGES and FILTER!

"Twist of the Wrist" Interchanging of all Cartridges, Filters, Accessories

AO presents the R2000 Respirator with a new type of retainer shell that accommodates 7 types of quickly INTERCHANGEABLE cartridges — THREE FOR PROTECTION AGAINST DUSTS — FOUR FOR GASES AND VAPORS — plus a DISK TYPE, CHEMICALLY TREATED DUST FILTER — eight respirators in one. Thus, for the first time, an overall dust respirator of the chemically treated, replaceable filter type provides secure protection against both specific dusts and specific gas and vapor hazards merely by interchanging the cartridges. Four new all metal chemical cartridges of NON-SPARKING, seamless aluminum protect against fire hazards, weigh less than previous types and have increased fill for added adsorptive capacity. Deterioration caused by moisture and rough handling is retarded.

APPLICATIONS & ADAPTATIONS

R2000

Compact, five inch chemically treated "throw away" R25 filter has the efficiency of previous filters eight times its size. Protects against both poisonous and disease-producing dusts and against a *combination of all dusts* — toxic, nuisance and pneumoconiosis-producing. Gauze pre-filter adds to filter life by blocking entry of larger particles. Approved by Bureau of Mines, No. 2154.

R2031 — (R31 Cartridge)
For low concentrations of light organic fumes, vapors and gases generated in paint spraying, degreasing, dry cleaning, cementing, etc. Adsorbs benzene, xylene, toluene, gasoline, acetone, turpentine, etc.

R2032 — (R32 Cartridge)
For low concentrations of acid gases, fumes and mists such as sulphuric acid, hydrogen chloride, nitric acid. Protects against fumes from plating and pickling tanks, etc.

R2033 — (R33 Cartridge)
For low concentrations of combined acid and organic gases such as halogenated hydrocarbons and trichlorethylene; carbon tetrachloride, acetic acid. Protects against gases, fumes and vapors in degreasing operations, etc.

R2034 — (R34 Cartridge)
For nuisance concentrations of ammonia only.

R2015 — (R15 Cartridge)
For nuisance and pneumoconiosis-producing dusts in mining, quarrying, tunneling (quartz, sand, asbestos, coal, marble). *Not* to be used against vapors, gases or toxic dusts. Bureau of Mines Approval No. 2121.

R2016 — (R16 Cartridge)
For toxic dusts caused by grinding and crushing lead, cadmium, arsenic, chromium, manganese, selenium, vanadium. *Not* to be used against gases or vapors of above material. Bureau of Mines Approval No. 2138.

R2017 — (R17 Cartridge)
For a combination of all dusts, including toxic, pneumoconiosis-producing and nuisance dusts. *Not* to be used against gases or vapors. Bureau of Mines Approval No. 2138.

Order from your nearest AO Safety Products Representative and consult him about the protection to meet your needs.

American Optical

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Southbridge, Massachusetts • Branches in Principal Cities

Here's 'ROUND-THE-CLOCK Jacking POWER

Plus SAFETY and EFFICIENCY

Simplex HYDRAULIC JACKS

Specifying Simplex Hydraulics puts Jacks to work at scores of jobs . . . steps up efficiency with dependable versatility plus these added advantages: Smooth hydraulic power; an extra safety margin; construction throughout that insures lasting service with minimum attention.

Simplex Hydraulic Jacks are available in eight models with capacities from 3 to 100 tons. The 30, 50 and 100 ton models have double pumps; others single pumps. All models are safety-tested to 50% over rated capacity.

CHECK THESE SIMPLEX-ENGINEERED FEATURES

- High-pressure packing seals of Neoprene.
- Non-sticking, spring controlled ball valves.
- Operate vertically or horizontally.
- Pressure-tested bases.
- Drop-forged steel caps.

SEND FOR BULLETIN: HYDRAULIC—49

1899 1949

Simplex LEVER • SCREW • HYDRAULIC Jacks

Tune in the RAILROAD HOUR ABC NETWORK

TEMPLETON, KENLY & COMPANY

1018 S. Central Avenue • Chicago 44, Illinois

inches. Since both pump and motor are completely submerged, the electric motor is kept cool by the flow of water passing the motor and entering the pump. Jacuzzi Bros., Inc., 5327 Jacuzzi Ave., Richmond, Calif.

•

Hand Pallet Truck

Lightweight hydraulic pallet truck is designed for use with expendable 4-way corrugated paper pallets having large cylindrical supporting columns. Forks are 6 inches wide with a 10-in. opening between, providing an over-all width of 22 inches. Rubber-tired front wheels, handle hold-up, and foot pump with separate pedal release are other features. Friction brake engages the floor when the towing handle is held in "down" position. Capacity is 2000 pounds; lowered height, 3¼ inches, elevated, 7¼ inches. Booster rolls in the fork ends also permit the truck to operate in standard double-faced wooden pallets. Lyon-Raymond Corp., 2489 Madison St., Greene, N. Y.

•

Thermometer

Glass tube type refrigeration thermometer has a flexible copper connecting tube running to the temperature-responsive bulb. Large-diameter capillary bore is said to eliminate the need for magnifying the red liquid with which it is filled. Well at top of tube protects the thermometer from damage through high temperatures. Available in ranges from —50 to +300 degrees F., with ranges calibrated to match predetermined scale lengths. U. S. Gauge, Div. of American Machine & Metals, Inc., Sellersville, Pa.

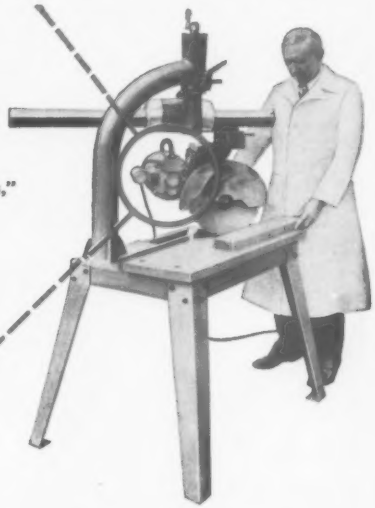
•

Acid Drainer

For use with manufacturer's "Carboy Tilter," safety drainer is designed to pour acids without spilling

A.O. Smith Builds ELECTRIC MOTORS

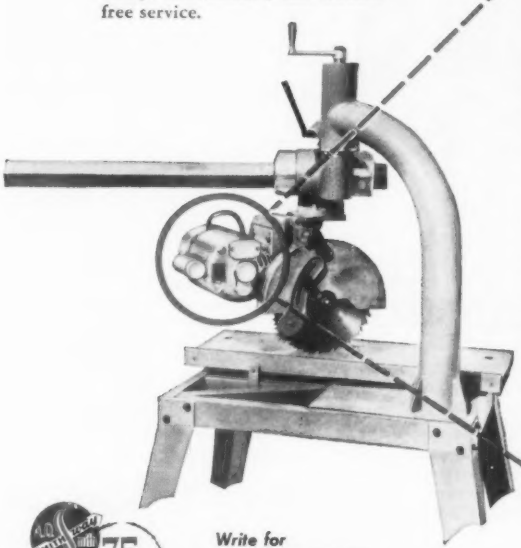
for hundreds of products, including Mooradian Swing, Table, and Radial Saws



At A. O. Smith, where research itself has long been "big business," our research and engineering staff is at your disposal—to help integrate electric-motor design with your product design.

Typical of the many problems A. O. Smith has solved in engineering electric motors to specific product requirements is that of Mooradian Manufacturing Co., whose multi-purpose radial saw is pictured here.

If you are seeking improved performance in your product, or if you require special characteristics in your power component—in standard or custom-built motors—consult the A. O. Smith man. SMITHway Electric Motors are designed and built to bring to each application the maximum in compactness, safety, convenience, and trouble-free service.



MOORADIAN PORTABLE RADIAL SAW, product of Mooradian Manufacturing Co., Los Angeles 11, does the work of six machines. It has a wide range of uses, including compound miters. The operator can "gang-up" long pieces to cut multiple parts. Belt drive permits choice of many speeds not obtainable with direct-drive saws.

Says C. C. Compton, Mooradian general manager: "We especially prefer and recommend SMITHway high-speed motors because they are lighter in weight, less bulky, very powerful, and vibrationless. They deliver when the going gets tough, and make good clean cuts. They are ideal for woodworking equipment. We use them exclusively on our complete line of swing, table, and radial saws."

SMITHway ELECTRIC MOTORS for Mooradian Saws are 3450 rpm, single-phase, 115/230 v., capacitor start, ½, ¾, 1, and 1½ hp. Light, compact, with high breakdown torque, they have pre-lubricated, shielded ball bearings self-protected from sawdust and dirt. Modern SMITHway design makes them highly suitable for today's modern tool and machine designs.

ask the A. O. Smith man about electric motors for both standard and special uses

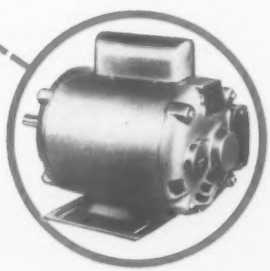
Write for Bulletin No. EM-152

A. O. SMITH Corporation

New York • Boston • Cleveland • Atlanta • Chicago Detroit • Milwaukee • Houston • Tulsa • Dallas • Denver Seattle • Los Angeles • San Francisco • Motor Export Department: 13 East 40th St., New York 16

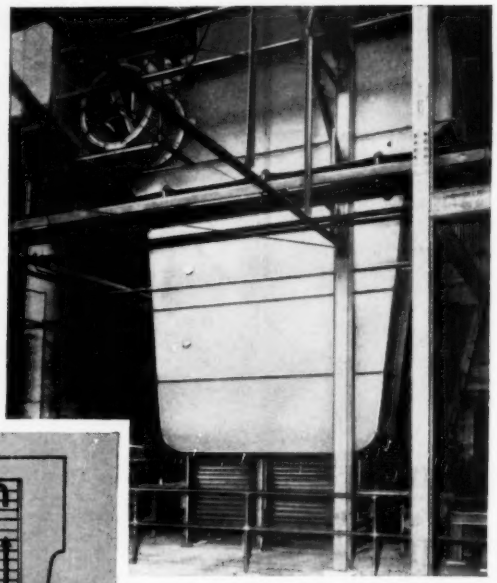
24-HOUR MOTOR SERVICE

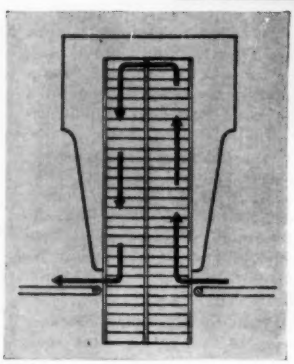
The A. O. Smith Product Service Division provides fast, low-cost electric-motor service to more than 200 authorized service stations, on a 24-hour, off-the-shelf basis. Factory Service Branches and Warehouses at Union, N. J., Chicago, Los Angeles.



OLSON CONVEYORS

CONTINUOUS MATERIAL FLOW





IN THE MANUFACTURE OF

BUILDING MATERIALS

• Here is a Subveyor that serves as a drying oven for sections of roofing material. Used in conjunction with Olson horizontal chain conveyors, flow is continuous with no interruption of the manufacturing process. Valuable floor space is saved since the drying operation is performed vertically.

Olson conveyors include *all* types necessary to cut handling costs in any business or industry. Whether your application calls for a single unit or a complete system . . . a combination of standard and custom-built units . . . it will be tailored to meet your particular needs. Call Olson today. Get the details about really efficient handling through *continuous material flow.*

SAMUEL OLSON MFG. CO., INC.

2424 Bloomingdale Ave., Chicago 47, Illinois

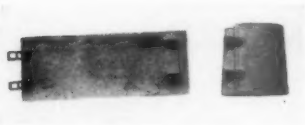
or splashing. Air vent provides uninterrupted flow of liquid. Soft rubber neck fits various sizes of carboys; vent and spout are made of hard acid-proof rubber. Available in three sizes ranging from 5- to 13-gal. capacity. Wahlert Safety Products Corp., 25 Lafayette St., Brooklyn 1, N. Y.

•

General-Purpose Winch

Planetary-gear type winch has a 5x5¾-in. heavy steel mounting plate which may be attached to any flat surface. Winch drum, which encloses all the mechanism, is 4 inches in diameter, has 6-in. flanges, is 6¼ inches long. The 12-in. crank handle can be swung out of the way when not in use. Direct cable pull is 600 pounds, and each revolution of the crank winds up 3 feet of cable. Various lengths of ¼-in. cable with a swaged end fitting are available, and a total of 24 feet can be wound in two layers on the drum. Lewis-Shepard Products, Inc., 268 Walnut St., Watertown 72, Mass.

•



Pants Guard

Designed to prevent workers' catching their pants cuffs in moving machinery, guard, called Gardwell No. 1006-PG, is made of duck, completely encloses the trouser cuff, extends six inches up the ankle. Two arctic buckles permit adjustment in fastening. Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3.

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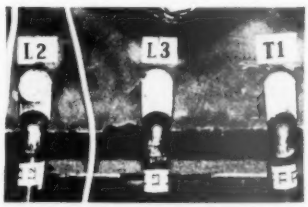
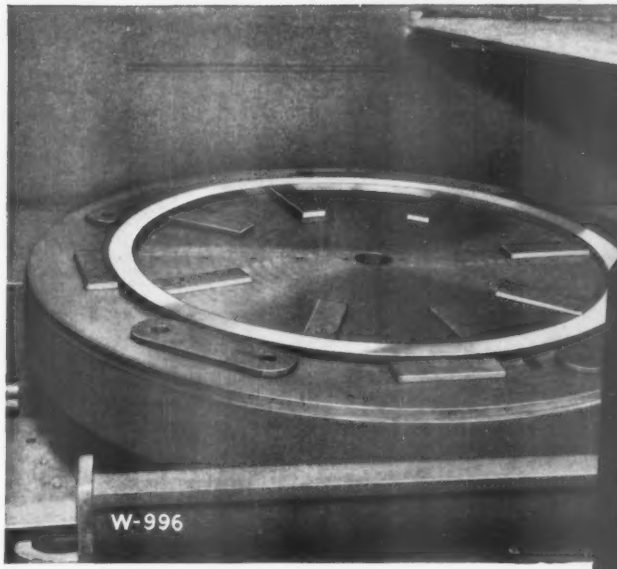


Terminal Markers

For identification of terminals, harness boards, switches, and panels, self-adhesive markers, called Spot-it, may be applied without moistening by fingertip pressure to any wire end or terminal. Markers are covered with protective coating to re-



A SAVING OF $8.00 PER PIECE

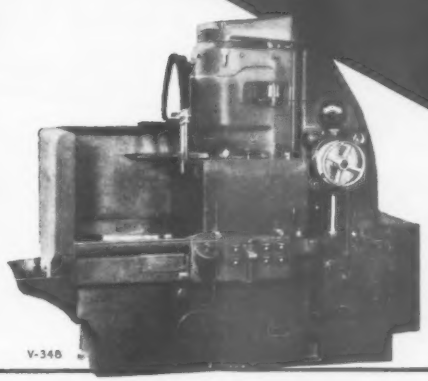
WHEN THEY.... PUT IT ON THE BLANCHARD

Yes, this special alloy stainless steel ring 28" x 2½" x 9/16" was finish ground on the No. 18 Blanchard Surface Grinder with 36" chuck at a saving of $8.00 per piece over previous method.

Machining this alloy stainless steel ring by the previous difficult method cost $9.00 per piece. The combination of Blanchard Grinder, Blanchard Engineering, and wheel selection reduced production cost to $1.00 per ring. One side was ground removing .070" of metal to close dimension and flatness tolerances.

Here again is proof positive that the most profitable words in flat surface machining are "Put it on the Blanchard."

Are you machining your flat surface the most economical way? Talk it over with Blanchard.



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Send for your free copy of the first edition of "Art of Blanchard Surface Grinding." This newest of Blanchard books shows you how to get best production results with Blanchard Surface Grinders.

BLANCHARD

The BLANCHARD MACHINE COMPANY

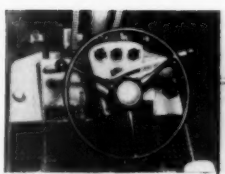
64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

SERVICE
MoTowLift 1949

Powered with
FORD
Industrial Gas Engine
("Around-the-Corner" service everywhere)

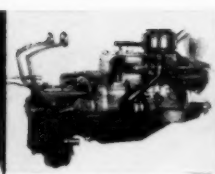
MORE FOR YOUR LIFT TRUCK DOLLAR!

PROVE MoTowLift's ADVANTAGES TO YOURSELF . . .



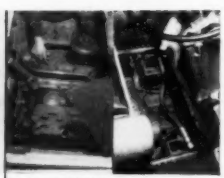
1. SUPERIOR PERFORMANCE

UNI-LEVER control tilts mast, raises and lowers load. Instruments clustered in front of driver. Improved maneuverability through easier steering. Greater driver comfort.



2. FORD INDUSTRIAL ENGINE

Built for heavy-duty, grueling service. MoTowLift's Ford engine gives dependable, around-the-clock operation—and service is as near as your neighborhood Ford dealer.



3. EASILY ACCESSIBLE

Parts and assemblies quickly accessible for inspection and service. Repair costs are lower with MoTowLift — "down-time" is at a minimum.

Call your nearest distributor and get *all* the facts.
For complete specifications write for MoTowLift Bulletin.

CASTERS
FLOOR TRUCKS
LIFTERS
LIFT TRUCKS

SERVICE CASTER & TRUCK CORP.
Executive Offices: Albion, Michigan
Plants at Albion, Michigan and Somerville 43, Mass.
See your classified Telephone Directory for name of nearest Service Distributor.

sist dirt, grease, and moisture. Printed black-on-white, they measure $\frac{3}{8}$-in. square, with one number or letter appearing on each. Mounted on pocket-size cards, 40 to a card, numbered in series or from A to Z. Western Lithograph Co., 220 Rose St., Los Angeles 54.

•

Hand Pump

Diaphragm - type high - vacuum hand pump, available in several models, including barrel and underground tank types, is said to pump fluids up as much as 25 feet vertically. It dispenses fluid in a steady flow on both back and forth strokes, according to manufacturer. Delivers 20 gallons per 100 strokes, will prime a 20-ft. lift in 12 strokes. Available with 8-gal. counter-totalizer and with hose and automatic shut-off nozzle or spout with pail hook, or with cast-iron base for use with underground storage tank. Tokheim Oil Tank & Pump Co., Fort Wayne, Ind.

•

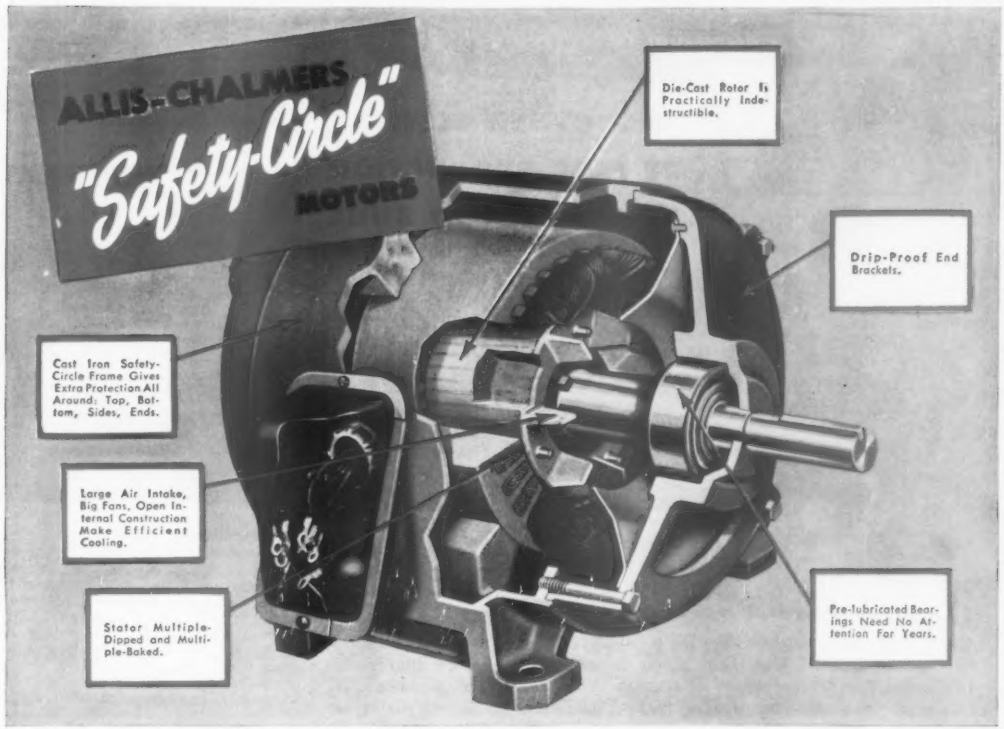
Capacitors

Line of pyranol-filled capacitors, suitable for outdoor service, is available in ratings of 2, 3, 4, 5, and 6 kvar, at 460 volts. Units may be mounted in any position. Each has 4-ft. flexible flamenol-jacketed cable, with ground wires, and $\frac{3}{4}$-in. watertight connector at end of cable for knockout connection to the motor starter. Connection fitting on capacitor case may be removed and standard conduit fitting substituted for conduit insulation. Transformer & Allied Product Div., General Electric Co., Schenectady 5, N. Y.

•

Platform Truck

Electric power truck with low-lift platform, 40x140 inches, is suitable for transporting heavy cylindrical


ALLIS-CHALMERS
"Safety-Circle"
MOTORS
Die-Cast Rotor Is Practically Indestructible.
Drip-Proof End Brackets.
Cast Iron Safety-Circle Frame Gives Extra Protection All Around: Top, Bottom, Sides, Ends.
Large Air Intake, Big Fans, Open Internal Construction Make Efficient Cooling.
Stator Multiple-Dipped and Multiple-Baked.
Pre-lubricated Bearings Need No Attention For Years.

HOW SAFETY-CIRCLE

Means Motor Dependability

EXTRA PROTECTION means extra dependability. That's why Allis-Chalmers protects the working parts of the motor with the exclusive SAFETY-CIRCLE. Compare this motor with motors of less rigid construction. The SAFETY-CIRCLE motor will not distort in mounting or under strain. And you get the extra protection of drip-proof end brackets at no premium.

EXTRA PROTECTION INSIDE, TOO

Stator is multiple-dipped and multiple-baked in special insulating varnish. Rotor is die-cast aluminum. Stator is mounted in four longitudinal ribs which leaves plenty of air space between stator and frame. Large fans cast integrally with the rotor and ample air intakes keep temperatures well within rated limits. *Ball bearings are factory-lubricated and require no further attention for years.*

When you shop for motors, remember SAFETY-CIRCLE gives you *extra protection, extra dependability* and *lower operating costs.*

For details on SAFETY-CIRCLE advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Sizes 1 to 20 hp, 326 frames and smaller. *Safety-Circle, Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 1078A SO. 70 ST. A-2691
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

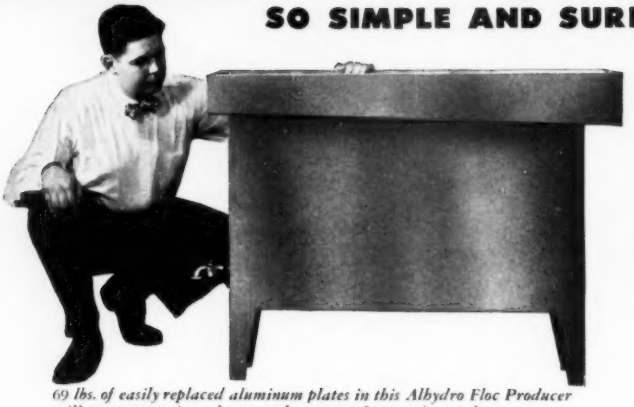
TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

For Industrial And Municipal Water Treatment Plants

Alhydro FLOC PRODUCER

NO OTHER METHOD OF FLOC PRODUCTION SO SIMPLE AND SURE



69 lbs. of easily replaced aluminum plates in this Alhydro Floc Producer will treat approximately as much water as ¾ ton of coagulants . . .

Since the Alhydro unit employs the principle of low voltage d.c., electrolytic dissolution of aluminum plates in water to produce aluminum hydroxide floc, it completely eliminates the conventional problems of shipping, handling and storing bulky chemicals. Moreover, there is seldom any need for chemical feeders—production of Alhydro floc is controlled with a simple turn of a dial.

Tests conducted under wide variation of conditions have proved that the Alhydro Floc Producer assures efficient coagulation over a wide range of water temperatures, clarity and pH, and in most instances completely eliminates the necessity for corrective chemicals.

One Alhydro unit treats approximately 300,000 gals. per day . . . multiple unit installations are used for larger requirements.

"We are enlarging our present plant and will include 8 Alhydro units instead of the 5 we now have. Here are a few reasons:

1. Less storage space required for chemicals
2. Cost is practically the same as chemical coagulants
3. Minimum of attention by only one operator. To increase the floc volume, the operator simply increases the amperage by turning a dial
4. Floc forms rapidly and does not change pH of water so we are able to produce a stabilized water with this method."

• Clifford Love, District Manager

Read what the Illinois Cities Water Co. of Mt. Vernon, Illinois says:

GET THE FULL DETAILS

Read this folder which illustrates and describes the features and advantages of the Alhydro Floc Producer in treating drinking water or water for industrial use. Write for your free copy today.

ALHYDRO, INC. DEPARTMENT 7D 516 N. CHARLES ST., BALTIMORE 1, MD.

objects. Stakes placed in the two parallel rows of pipe sockets prevent load from rolling off. Raised height, 30 inches; lowered height, 24 inches. Load capacity is 6000 pounds. Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 14.

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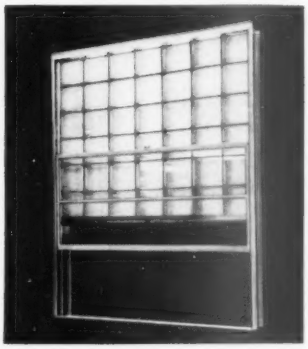


Glass-Block Window

Glass-block window with a sliding vision strip can be installed in conventional window openings, and according to maker is strong and rigid enough to provide its own lintel. Frames are shipped completely assembled, ready for installation of the glass block. The sliding sash makes it possible to wash the outside of the window. They may be used singly or in multiples, in single pane or double glazing. When installed in groups, the jambs are said to act as mullions, eliminating the need for additional intermediate structural members. American Structural Products Co., Subs. of Owens-Illinois Glass Co., Toledo 1.

•

Intercommunication System

Available in 20- or 40-call capacity, intercommunication equipment, called Wheelock Code Call, is designed for use in conjunction with regular telephone switchboard. When a telephone is unanswered, operator broadcasts the code signal on bells, horns, or other device located throughout the plant, and call may be taken at the nearest telephone. Signal Engineering & Mfg. Co., 154 W. 14th St., New York 11.

•

Faucet Insert

Replacement part, known as the Simplex Faucet Insert, is made with a brass stem and rubber sleeve, to

Photography can make this page

this small

IT'S DONE WITH MICROFILM MAGIC

TINY AS IT IS, the little rectangle above is this page in black and white—as it appears on microfilm. Everything there, condensed to a mere spot, but ready to be brought back full size with all its features intact. For photography can reduce tremendously without losing a detail.

Industry can use this ability of photography to reduce, in many ways.

You can use it to save space and speed up reference. With Recordak or Kodagraph microfilming you can debulk files of drawings, data, and documents by 99%—keep film records at hand for quick full-size viewing.

You can use photography to compress the operation of a giant, widespread industry into a motion picture, ready to be shown any time for instruction or promotion purposes. You can pack a mammoth press, a whole process, into a can of film, travel it where you will, show it time and time again, accurate in every detail.

All this and much more because photography can condense. And because it has many other unique characteristics as well, photography is becoming an increasingly important tool all through science, business, and manufacturing.

You may be looking for a way to improve methods of recording, measuring, manufacturing, and selling. If you are, be sure to investigate the abilities and advantages of photography.

Eastman Kodak Co., Rochester 4, N. Y.

Functional Photography

—is advancing industrial technics

Kodak

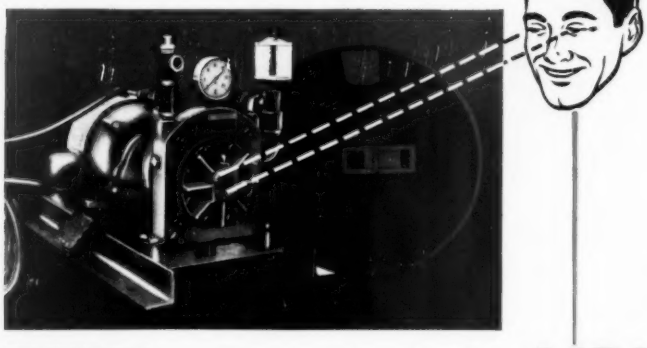
Dry bulk materials flow evenly through hopper with dry aeration from a

GAST rotary AIR COMPRESSOR

PROBLEM: Assure an even flow of dry bulk material through bin hoppers of portable and stationary concrete plants.

SOLUTION: Aeration of material around hopper opening with low pressure of 10 to 15 p.s.i., volume of 8½ c.f.m. A Gast 1065-P17 Rotary Air Compressor supplies dry, non-pulsating air at low cost with ½ to ¾ h.p. motor or V-belt from gas engine.

RESULT: Excellent. This manufacturer has used Gast Units as original equipment for many years.



Another problem solved with AIR!

Whether your problem is similar—or far different from this—you too may find that "Air may be *your* Answer". As original equipment for literally hundreds of applications, Gast Rotary Air Compressors, Air Motors and Vacuum Pumps help manufacturers to improve their *products*—and *save money!*

For example, consider the Air Compressors used on this application. They deliver *positive pressure without pulsation* . . . and *without a bulky air tank* . . . at lower initial cost. And they offer many other advantages—resulting from the *utter simplicity* of their sliding-vane Rotary Design.

It may pay you to investigate the performance and economy of Gast's more than 200 models. Inquire today . . .

WRITE TODAY!

Request your copy of this NEW booklet, "APPLICATION IDEAS"

"AIR MAY BE YOUR ANSWER!"

GAST ROTARY

AIR MOTORS • COMPRESSORS • VACUUM PUMPS

(TO ONE H.P.) (TO 30 LBS.) (TO 28 INCHES)

GAST MANUFACTURING CORP., 137 Hinkley St., Benton Harbor, Mich.

withstand water pressures and temperatures as well as chemicals. Fiber washer in lower surface of the sleeve serves as a stationary gasket on the faucet seat. Simplex Faucet Co., 10506 Madison Ave., Cleveland.

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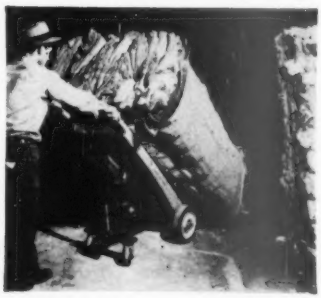

Bale Truck

One-man handling of 1800-lb. 72-in. bales, as well as lighter objects, is made possible by use of bale truck constructed with a leverage plate which extends 28 inches from the axle to the rear casters. A contoured foot rest permits operator to apply foot pressure to plate, grasp and pull top wire, which automatically lifts the bale toward him and brings it into wheeling position. Steel tripod support and rear casters balance and carry weight of the bale. A tilt-and-lock mechanism changes the angle of the truck for balance and ease in handling loads. Melooz Mfg. Co., Inc., 4730 Avalon Blvd., Los Angeles.

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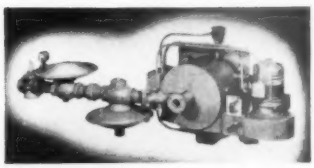


Gas Boiler Burner

Self-contained boiler gas burner, Series 115, is a package unit which may be installed in either new or old boiler settings, according to maker. Two sizes are available, the 115-2.5 for 2½ million Btu. input, and the 115-5, for 5 million, which develop approximately 50 and 100 boiler-horsepower, respectively. Combustion air is furnished through the burner by a blower which is an integral part of the burner, permitting accurate fuel-air ratio control. Control panel with modulating control makes the unit automatic. The North American Mfg. Co., 4455 E. 71st St., Cleveland 5.

•

Floor Polish

Called Trafco, solvent-type non-slip floor polish for wood floors is said to produce a high sheen that is resistant to scuffing and traffic wear. Spirit base is harmless to wood; may also be used on linoleum, linotile,

Low Operating cost

PLUS New Low Prices

Low operating cost has long made Frigidaire Water Coolers the choice of experienced buyers. And now, at new low prices, these efficient, dependable coolers offer greater value than ever before!

Guided by more than a quarter century's experience in the field of refrigeration, Frigidaire makes water coolers that are famous for long life—for years of low cost, trouble-free operation. They're built for heavy duty, thickly insulated and powered by the one-and-only Frigidaire Meter-Miser. The Meter-Miser is the simplest cold-making mechanism ever made—sealed in steel and oiled for life. That's why current costs are so small—and upkeep negligible. The Meter-Miser has set performance records in millions of Frigidaire products—carries its own, special 5-Year Warranty.

ONLY FRIGIDAIRE HAS THE METER-MISER

Whatever your water cooling needs, there's sure to be a Frigidaire to meet them. For complete information, call your dependable Frigidaire Dealer. Find his name in Classified Phone Book, under "Water Coolers" or "Refrigeration Equipment." Or mail coupon at right to Frigidaire Division of General Motors, Dayton 1, Ohio. (In Canada, Leaside 12, Ontario.)

Frigidaire Pressure-Type Water Coolers
Available in five models, ranging in capacity from 3 to 20 gallons per hour.

Frigidaire Industrial-Type Coolers
For factories, cafeterias, etc. Built to withstand hardest kind of usage. Reciprocating-type compressor only. 25 and 30 gallon capacities.

Frigidaire Tank-Type Coolers
May be suspended or concealed almost anywhere. Several tanks can be joined and operated by a single compressor. 19, 30, and 51 gallon capacities.

Frigidaire Water Coolers

THE ONLY WATER COOLERS WITH THE METER-MISER

For fast facts about Frigidaire Products—fill in and mail coupon today

Frigidaire Air Conditioning
☐ Room conditioners; store type conditioners; central systems. For controlling temperature, humidity, dust. For improving product quality and working conditions.

Frigidaire Electric Dehumidifier
☐ Prevents moisture damage, retards rust, mold and mildew, speeds paint and plaster drying in areas up to 25 x 40 x 8 ft. Plugs into any 115V 50/60 cycle outlet.

Frigidaire Water Coolers
☐ Self-contained types for offices and factories. Tank type for industrial water cooling—for cooling spot-welding electrodes, for heat-treating, for high speed coolants.

Frigidaire Low Temperature Cabinets
☐ For storing aluminum alloy rivets in an annealed condition. For shrinking metal parts prior to assembly and many other uses. Ice Cream Cabinets for cafeterias and factory stores. 4 to 10 hole capacities.

Frigidaire Compressors
☐ For use with cooling units and tank-type water coolers and other applications.

Frigidaire Cooling Units
☐ Forced air cooling for hardening wax products and for controlling temperatures in a wide variety of manufacturing processes.

Frigidaire Reach-in Refrigerators
☐ Self-contained and remote types up to 60 cu. ft. For cafeterias and factory stores.

Frigidaire Beverage Coolers
☐ Self-contained and remote types, for wet or dry storage. For cafeterias and factory stores.

Over 400 Frigidaire commercial refrigeration and air conditioning products – most complete line in the industry.

Name.....

Firm Name.....

Address.....

City.....

County.....*State*.....

New Cloverleaf Diffuser gives added flexibility to Projection Unit Heaters. Easily adjustable, the diffusion pattern exactly fits the needs of the job.

How do you like your unit heaters... with, or without?

How do you like your unit heaters ...with or without adjustable diffusers? . . . with or without ductwork? . . . with or without ventilation air? . . . high velocity delivery? . . . low final temperature?

Do you want propeller type . . . blower type . . . vertical discharge . . . horizontal discharge . . . floor, wall, or ceiling mounting?

You can have what you want, *but not in any one type of unit.* Four distinct types are needed to meet requirements encountered constantly on jobs of any scope.

How do *you* handle such situations? Do you select from limited lines and juggle the job to fit the units? Or do you come to Trane, where *all four* basic types—shown below—are available? Select from this complete line and you won't have to put square unit heater pegs in the round holes of job requirements.

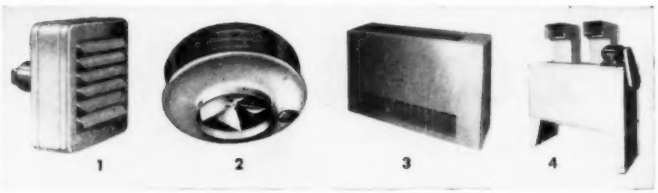
And remember, too, at this one-stop source of supply you can also secure your convectors, coils, unit ventilators, and heating specialties for steam or hot water. One company; one responsibility. And back of it all, on-the-spot cooperation from the best-trained engineering sales staff in the industry.

You have everything to win—with Trane.

THE TRANE COMPANY, LA CROSSE, WIS.

Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties . . . IN CANADA, TRANE COMPANY OF CANADA LTD., TORONTO.

Here are the "Four Freedoms" of unit heater selection: 1. *Twenty-four* sizes of horizontal units, 2. *Sixteen* sizes of vertical projection units; 3. *Twenty-four* combinations of compact force-flo heaters, 4. *Sixty-eight* standard arrangements of blower units.



cork, and similar resilient floors. Walter G. Legge Co., Inc., 101 Park Ave., New York 17.

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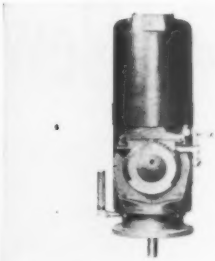
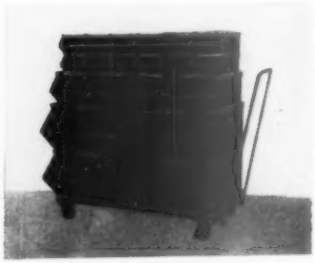


Variable Speed Transmission

Designed for vertical flange mounting, variable speed transmission, Type F, is said to produce speeds from zero to 1100 rpm. Available in sizes from ¼ to 1 horsepower, it has standard NEMA flange mounting dimensions and can be furnished with special shaft extension. Device called Micrometer Control makes possible accurate speed settings, according to the manufacturer, who states that the transmission maintains its set speed even with change in load, making it suitable for metering and proportioning uses or mixing applications where change in viscosity occurs. Graham Transmissions, Inc., 3754 N. Holton St., Milwaukee 12.

•



Bin Truck

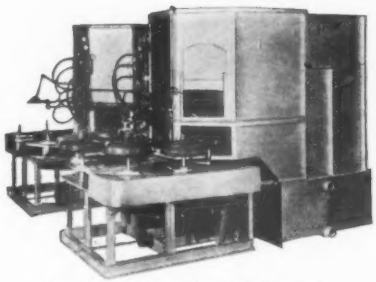
Stock truck, for use with manufacturer's interlocking steel Stackbin sections, holds units of two to six bins, in five different sizes. The hopper-front bins stack compactly on the truck, and nest together rigidly, according to maker. The truck is available separately, or with various combinations of metal sections. Stackbin Corp., 1129 Main St., Pawtucket, R. I.

•

Reflector Fasteners

Developed to facilitate latching or releasing fluorescent light fixture reflectors, fasteners, called Speed Clips, are held in reflector case by a lip-and-catch device. The spring arm extends down through the rectangular hole in the case, and forms thumb lever to permit attachment or

Putting Air to Work!



Here is a typical example of DeVilbiss engineering skill. This DeVilbiss automatic paints brake drums at the rate of 1,000 per hour. Possibly some phase of your finishing can be done automatically.

Here is a master craftsman—the glass-blower—putting air to work in the practice of his highly skilled profession. Glass-blowers of old were elevated to the nobility and many of their beautiful creations have come down to us through the ages as fitting testimonials to the enduring worth of work well done.

For 61 years DeVilbiss has also made an art of the business of putting air to work. As a result of this long time specialization in increasing production and lowering costs, the name DeVilbiss on a product or complete finishing system is accepted to mean just one thing . . . *nothing better for the purpose can be found anywhere.*

The unsurpassed speed and efficiency of DeVilbiss systems save valuable man-hours, cut costs, help you produce for less—sell for less. DeVilbiss is today's leading authority on "how to spray it best at lowest cost." When you want such information and the equipment that will do your job best, call DeVilbiss.

THE DEVILBISS COMPANY • Toledo 1, Ohio

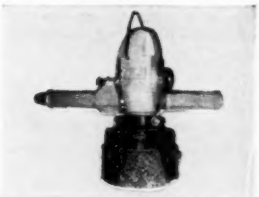
Canadian Plant: WINDSOR, ONTARIO

DE VILBISS *means* **Quality-***in all four . .*

DV

SPRAY EQUIPMENT
EXHAUST SYSTEMS
AIR COMPRESSORS
HOSE & CONNECTIONS

CORRECT ANGLE of handle in relation to motor housing insures true balance . . . easy handling. Model 7025



4" CUP GRINDING WHEEL AND GUARD used for top-speed work with Aro Model 7194.

5" CUP WIRE BRUSH ideal for rust removal and similar jobs with Aro Model 7195.

More Power Per Pound

THAN ANY OTHER SANDER

★ **TRUE BALANCE**

★ **CORRECT SANDING SPEED**

★ **LESS AIR PER H. P.**

"Plenty of guts" for your toughest jobs! Gets the work done *faster* and *better!* New streamlined design . . . tough magnesium housing . . . governor controlled speed . . . new exhaust deflects and cools sanding pad . . . helical gears assure smoother operation and longer life. Choice of 7" backing pad, 4" cup grinding wheel with guard, or 5" cup wire brush. Write The Aro Equipment Corporation, Bryan, Ohio or see your nearest ARO distributor.

ARO
AIR TOOLS

Also . . **LUBRICATING EQUIPMENT** . . **HYDRAULIC EQUIPMENT** . . **AIRCRAFT PRODUCTS** . . **GREASE FITTINGS**

removal of the reflector. Tinnerman Products, Inc., 2035 Fulton Rd., Cleveland.

•

Inert-Gas Shielded Welder

Model TIH-200-S a.c. welder for inert gas welding has secondary reactor for supplementary low heat control. This is built into the machine and controlled by a hand wheel. Can also be used as an ordinary transformer-type welder. Hobart Bros. Co., Hobart Square, Troy, O.

•

Barrel Truck

Two-wheel barrel truck will handle 1000-lb. drum, weighs 63 pounds. Wheels 10 inches in diameter, $2\frac{1}{2}$ inches face width, with heavy-duty molded-on rubber tires. Maker states that spring-balanced wheel and assembly has a load-compensating movement that keeps truck in an erect position when not in use. Thomas Truck & Caster Co., Keokuk, Ia.

•

Solderless Terminal Blocks

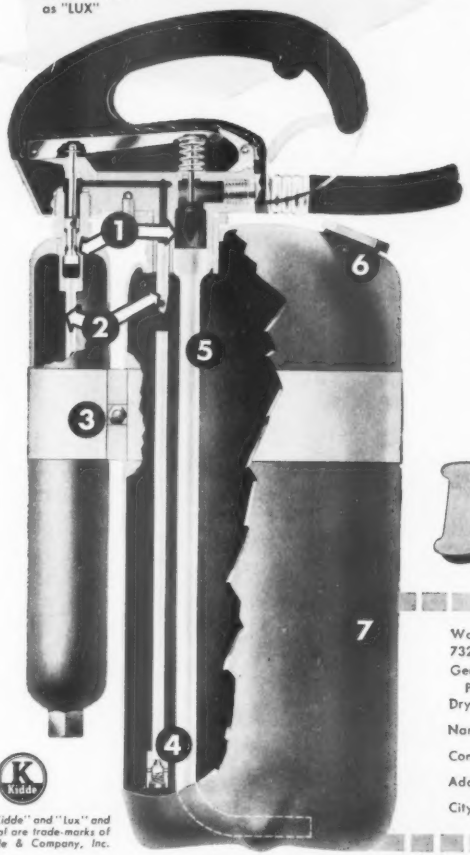
Molded terminal blocks, called Bepco, are provided with compression type solderless units, each capable of receiving wires from No. 15 to 6 AWG. Attachment of wires to block is accomplished by tightening screws after insertion of stripped wires. Rated at 35 amperes, 600 volts, they are made in 4-, 8-, and 12-circuit

A New DRY CHEMICAL EXTINGUISHER WITH Trigger-Finger Control

(nothing new to learn)

Here, at last, is an extinguisher that's designed *right* to make the most effective use of an effective fire-extinguishing agent. *Kidde* Dry Chemical Extinguishers—made in 20- and 30-pound capacities—are operated simply by pulling a trigger—the same familiar, time-tested method used on all *Kidde** carbon dioxide (CO_2) extinguishers.

*Also known as "LUX"



PLUS these 10 other big features

1 *Simultaneous opening of CO_2 and powder valves.* No trapping of gas pressure in powder chamber *before* the discharge starts.

2 *Quicker transfer of pressure to powder chamber.* Siphon tube carries CO_2 to outlet in powder chamber, where it expands to a gas.

3 *CO_2 cartridge easily replaced.* Just loosen name band holding cartridge—then unscrew cartridge. Same size cartridge for both 20- and 30-pound extinguishers.

4 *CO_2 fluffs up powder—prevents packing.* Small port at bottom of CO_2 outlet tube allows gas to stir up powder.

5 *Powder discharges from top through siphon.* No danger of packing at hose connection.

6 *Powder filler cap needs no tools.* Unscrews easily for refilling of extinguishers in the field. Filler cap is safety-vented.

7 *Lightweight cylinder for ease of carrying.* Pound for pound, the *Kidde* Dry Chemical Extinguisher packs more fire-fighting punch!

8 *Better powder dispersion pattern.* Diffusion baffle in horn gives greater coverage, more effective application. No shut-off valve in horn to trap powder under pressure in hose. No rodding out of hose after use.

9 *Extinguisher tested for operation at* −40°F.

10 *Improved powder and packaging.* Powder specially processed to make it free-flowing; packed in weatherproof containers. 30-pound carton contains three 10-pound cans—for easy refilling of either 20- or 30-pound extinguishers. 50-pound containers also available.

Walter Kidde & Company, Inc.
732 Main Street, Belleville 9, N. J.

Kidde

Mail the coupon for full information.

Walter Kidde & Company, Inc.
732 Main Street, Belleville 9, N. J.

Gentlemen:

Please send me further information on the *Kidde* Dry Chemical Extinguisher.

Name.....

Company.....

Address.....

City.....State.....

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Amazing advancements in television, radio and other fields are being made almost daily—not only in the products themselves—but also in their production. And, step-by-step with production advancements in every field of industry—since 1901—is The Alvey-Ferguson Co., *specialists in conveying equipment.*

The demand for merchandise may be up or down, but the demand for efficiency in modern industry is always present. No plant today can afford *inefficiency, unnecessary handling, undue breakage* or extreme *employee fatigue.* Your plant can eliminate these losses with an A-F *Engineered* Completely Co-ordinated Conveying System. Why be satisfied with less? *Write for a discussion of modern handling methods—today!*

THE ALVEY-FERGUSON COMPANY

137 Disney Street *Established 1901* Cincinnati 9, Ohio

Offices or Representatives in Principal Cities—Coast to Coast

CONVEYING EQUIPMENT
Alvey-Ferguson
METAL PRODUCTS CLEANING EQUIPMENT

sizes. Screw-on covers available. Buchanan Electrical Products Corp., 1290 Central Ave., Hillside, N. J.

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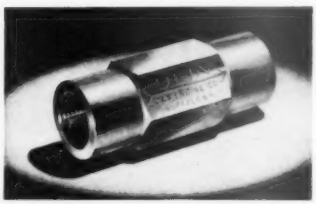


Shut-Off Valve

Automatic safety shut-off valve for use on compressed air lines is made to fit standard connections. It may be inserted at the intake end of the air hose. When a break occurs in the line, the valve closes and shuts off the pressure, permitting only a light stream of air to escape through a by-pass. This eliminates the necessity of turning off a valve before making repairs, and permits changing of tools without shutting off the air line. Olin Gas Engine Co., 9 Lafayette Ave., Buffalo, N. Y.

•

Spray Gun for Powder

Called the Schori Process Flame Spray Powder Pistol, spray gun is designed to produce a film or coating to facilitate evaluation of new materials or processes. According to maker, it will spray pigmented powders, plastics, or blends of materials, protective coatings, conductive, and nonconductive films, or any powdered metal or thermoplastic resin. It is claimed that as little as 50 grams of powder will produce a coating that can be subjected to test. Also available is a sample kit of powders to be used for testing, containing 11 metals and 13 plastics, packed in half-pint jars. Schori Process Div., Ferro-Co Corp., 8-11 43rd Rd., Long Island City 1, N. Y.

•

Magnetic Counter

For installations which do not require an extremely high number of

This amusing Nicholson advertisement appeared recently in *The Saturday Evening Post*. It is one of a series that has been running monthly for more than four years.

★ Nicholson and Black Diamond files are, we honestly believe, the best files in the world today. . . . Best for *lasting qualities*. Best for *trueness*—in straightness and even filing surface. Best for *accuracy in cut*. Best for *uniformity in hardness*. Best in *engineering design* for the job and material for which each type, cut and size is intended. Best, therefore, for IMPROVING YOUR WORKMEN'S EFFICIENCY, for INCREASING YOUR PRODUCTION, and for LOWERING YOUR FILING COSTS.

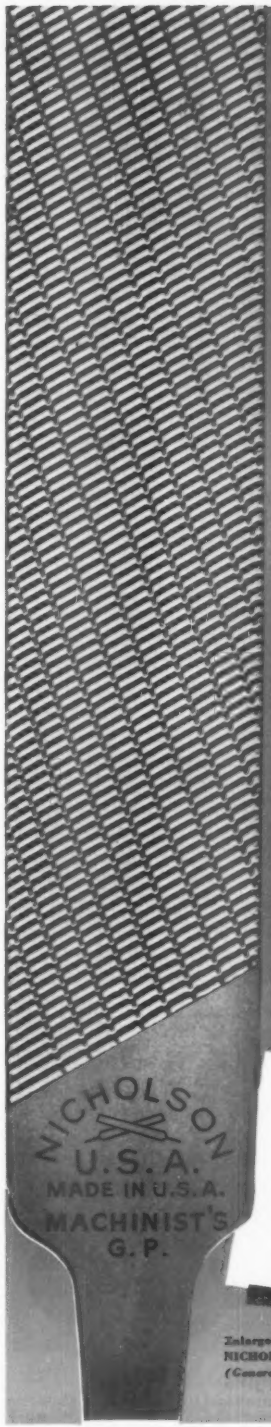
All these are basic reasons which are important controlling factors in selecting the file brand that assures you the *most for your money*. Your industrial distributor will tell you the same things.

FREE TECHNICAL BULLETIN *on special purpose files for Stainless Steel, Brass, Aluminum, Foundry Castings, Die Castings, Lathe Filing, Curved Tooth Files, Precision (Swiss Pattern) Files.*

FREE BOOK, "FILE FILOSOPHY" *(new, sixteenth edition) — an invaluable 48-page illustrated "textbook" on kinds, use and care of files. For production heads, purchasing agents, key mechanics.*

NICHOLSON FILE CO., 17 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON FILES FOR EVERY PURPOSE



Here's where YOU come in

Enlarged view of NICHOLSON MACHINIST'S G. P. *(General Purpose)* FILE . . . New!

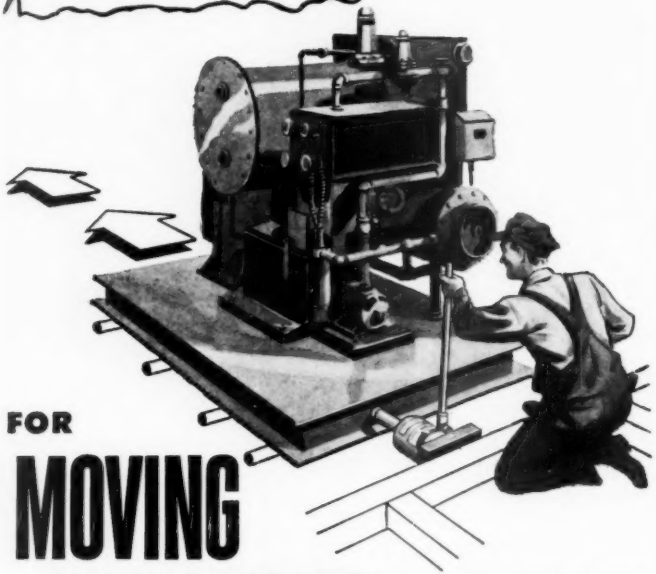
a Nicholson file for every purpose

★ . . . and made for longest service per file—utmost value for your money.

"FILE FILOSOPHY" *(new edition!)*, Nicholson's interesting and profusely illustrated 48-page book, tells about scores of regular and special purpose files, their use and care. Send for it. *FREE!*

NICHOLSON U.S.A. and

A HEIN-WERNER HYDRAULIC JACK IS A BASIC MAINTENANCE TOOL



FOR

MOVING

HEAVY EQUIPMENT..you can't beat the low cost, time saving efficiency of a HEIN-WERNER HYDRAULIC JACK

You'll save time—and time means money at maintenance jobs—when you put Hein-Werner Hydraulic Jacks to work for you. H-W Jacks give you full power at any angle from horizontal to vertical—and *full power* in a Hein-Werner means that it is absolutely dependable . . . factory tested at 1½ times rated capacity.

There's no better implement for moving heavy equipment—and no more versatile package of hydraulic power (up to 100 tons capacity) for bending, pressing, pushing or lifting operations at plant maintenance than an easy-operating, super powerful Hein-Werner industrial jack.

Made in models of 1½, 3, 5, 8, 12, 20, 30, 50 and 100 tons capacity. See your industrial supply distributor or write us.

H-W IS THE ANSWER TO 1001 MAINTENANCE PROBLEMS IN YOUR SHOP

Hein-Werner HYDRAULIC JACKS

HEIN-WERNER CORPORATION
WAUKESHA, WISCONSIN

accumulated counts or high speeds, Series 1268 non-reset magnetic counter may be built into equipment or machines as an original, integral part. Five large figures permit direct readings. Veeder-Root, Inc., Hartford, Conn.

•

Drain Cleaner

Reversible locking ratchet on drain-cleaning tool, called the Spartan Rod-O-Matic, grips, feeds, and releases 25 feet of cable automatically in 5-in. strokes. Manufacturer states that with the ratchet in forward position, the cable is fed into the drain, through the cross bar, around the trap and any number of bends, cutting the stoppage without the necessity of removing traps or cleanout plugs. Spartan Tool Co., 6007 N. Lincoln Ave., Chicago 45.

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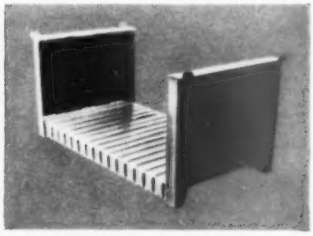


Pallet Rack

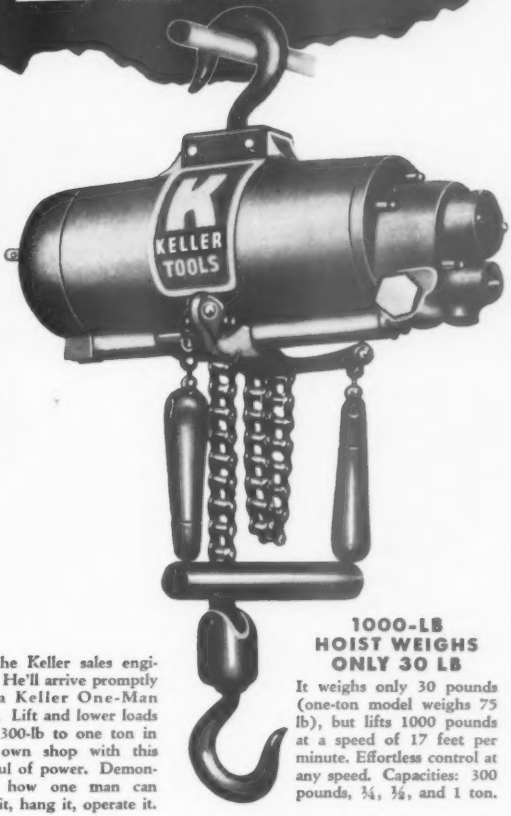
Open-side pallet rack can be used to tier unit loads of odd shapes and sizes, and will protect fragile materials from damage. Available for both heavy and light loads, when tiered four high, they will accommodate loading exceeding 24,000 pounds, according to manufacturer. The Union Metal Mfg. Co., Canton, O.

•

Goggles

Compression-molded of phenolic compound, chippers' goggles feature

Call Him! HE'LL DEMONSTRATE THE KELLER HOIST on Your Own Lifting Jobs



ONE MAN Can Carry It... or Hang It WITHOUT ASSISTANCE

Call the Keller sales engineer. He'll arrive promptly with a Keller One-Man Hoist. Lift and lower loads from 300-lb to one ton in your own shop with this handful of power. Demonstrate how one man can carry it, hang it, operate it.

1000-LB HOIST WEIGHS ONLY 30 LB

It weighs only 30 pounds (one-ton model weighs 75 lb), but lifts 1000 pounds at a speed of 17 feet per minute. Effortless control at any speed. Capacities: 300 pounds, ¼, ½, and 1 ton.

DESIGN FEATURES

HOUSING . . . one-piece aluminum-alloy casting.
BRAKE . . . fully enclosed, mechanical.
SAFETY LIMIT STOPS . . . on both ends of lifting chain.
LIFTING CHAIN . . . high-grade alloy steel roller chain.
HOOKS . . . drop-forged alloy steel.
AIR MOTOR . . . vertical piston design.
BALL BEARINGS . . . used throughout.
GEARS . . . 20° pressure angle planetary gearing.

KELLER *Air Hoists*

KELLER TOOL COMPANY — **GRAND HAVEN, MICHIGAN**

Here's what "KEX" NATIONAL SERVICE IS

. . . and why your plant can benefit from it

KEX NATIONAL SERVICE is a logical means of solving your industrial wiping problems by simply renting towels specifically made for wiping.

HERE'S HOW "KEX" NATIONAL SERVICE WORKS!

1

KEX NATIONAL SERVICE is as near as your telephone.

2

KEX INDUSTRIAL WIPING TOWELS are delivered to you in the quantities you want as you need them.

3

They are tied in neat bundles for easy storage, convenient handling and control of distribution.

4

KEX TOWELS are soft woven cotton—no abrasives to mar delicate surfaces—bound edges for safety—uniform in size—super-absorbent and clean.

5

Service is automatic—Pick-up of used towels and delivery of fresh ones are on a clock-work schedule that you make.

Manufacturers in every type of industry who have a wiping problem have found KEX NATIONAL SERVICE the efficient, economical way of solving it.

Look for this symbol in your local Classified Telephone Book. It identifies your nearest KEX distributor. Or write for details to KEX NATIONAL SERVICE, 295 Fifth Avenue, New York 16, N.Y.

"KEX" NATIONAL SERVICE

REG. U.S. PAT. OFF.

dome metal side screens, said to provide good side vision and adequate cup area for ventilation. Frame is nonflammable, moisture-, and heat-resistant. Chain bridge enclosed in a form-fit plastic covered tube is designed to rest lightly on the nose. Other features include large lens rings, one-piece rubber headband, and either Super Armorplate plano or 6-curve clear or Calobar type lenses. American Optical Co., Southbridge, Mass.

•

Battery Charger

Similar in every other respect to manufacturers' deluxe fast charger, new model battery charger does not include the before-and-after charge tests and the voltage regulator test. Assembled in a heavy-gage steel cabinet, it provides thermostatic control to safeguard batteries, and is capable of charging at a rate of 100 amperes, with slow charging facilities for from one to six 6-volt batteries. Willard Storage Battery Co., 246 E. 131st St., Cleveland.

•

Standing Mat

Intended for use where workers are on their feet for long periods, rubber mats are said to provide shock-cushioning standing area and firm nonslip surface. They protect against dampness and vibration. Made of a combination of sponge rubber cushion bonded to a semi-rigid corrugated top, they are available in sizes up to 12x4 feet, with thickness varying from $\frac{3}{8}$ to $\frac{7}{8}$ inch. Durable Rubber Products Co., 162 N. Clinton St., Chicago 6.

•

Air Circulator

Engineered to blow the air upwards along the ceiling, down the

Layout Man Illustrates Adaptability of Lufkin Inside "Mikes"...

Lufkin tools meet exacting requirements of layout man, John Adams, employed for 14 years at the Mesta Machine Co., Pittsburgh, Pa.

● Every Lufkin Precision Tool has features that are of practical aid to skilled craftsmanship. Lufkin Inside Micrometers measure I.D.'s. from 1½" up. Each rod is marked with its length and rods can be added to either or both ends of the micrometer head.

Tubular, light weight measuring rods can be added to both ends of the micrometer head—thus keeping the head central and in balance—assuring more sensitive "feel" and precise readings.

Ground threads on micrometer heads assure smooth operation and greater accuracy. Rods and caps ground to extremely close limits to permit interchangeability. Heads have "Rapid Reading" (each thousandth numbered) to eliminate errors in reading. Lock nut holds measurement firmly.

Flat surface on knurled collar opposite reading line makes it easy to instantly find reading line even in poor light.

It is easy to adjust micrometer head. Extension rods that show wear are also adjustable by turning hardened and ground plug either into or out of the rod.

Buy

LUFKIN

PRECISION TOOLS
TAPES • RULES

From your distributor

Write Dept. F1 for fascinating booklet, "The Amazing Story of Measurement." Enclose 10c (no stamps) to cover handling and mailing.

THE LUFKIN RULE CO.

Saginaw, Michigan • New York City • Windsor, Canada

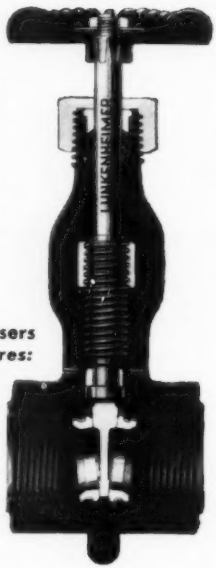
"The lowest-cost gate valve we have ever used!"

. . . that's what they say about the

LUNKENHEIMER
"King Clip" Gate Valve

THE first clip type valve was originally developed many years ago by Lunkenheimer and was one of the most popular gate valves ever designed. As service demands became more severe, the basic design was improved into the present "King-Clip". Twenty-one different patterns are now available for a wide range of service conditions in virtually all industries.

The "King-Clip" is truly the leader of all clip type valves . . . it offers you a money saving solution to many valve problems. See your Lunkenheimer Distributor. He has a stock available to serve you promptly. Write for Circular No. 561.



There are good reasons why so many valve users prefer "King-Clip" Valves. *Note these features:*

- Exceptionally strong body and bonnet construction.
- Extra length pipe threads for a strong, safe joint.
- Sharply tapered disc seats tightly.
- Large, unobstructed channels really drain the bonnet.
- Coarse stuffing box threads provide greater resistance to corrosion and stripping . . . reduce annoyance of leaky stuffing boxes.
- Easy to disassemble and reassemble.
- Exceptionally low maintenance cost.
- In bronze mounted patterns, rolled-in seat rings, integral non-corrodible stem thread bearing and special alloy stem assure longer life.

Fig. 1640 Iron Body Bronze Mounted . . . for steam, oil, gas, air, water and gasoline service.

Fig. 1644 All Iron . . . for handling solutions which attack bronze.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

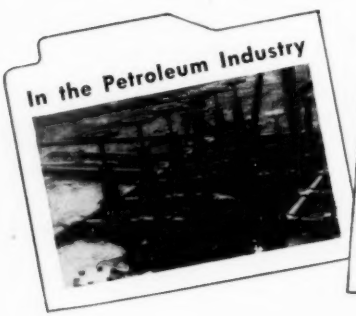
"QUALITY"

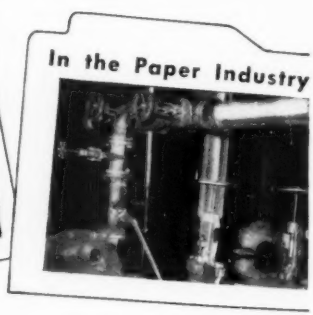
CINCINNATI 14, OHIO, U. S. A.

NEW YORK 13 · CHICAGO 6

BOSTON 10 · PHILADELPHIA 34

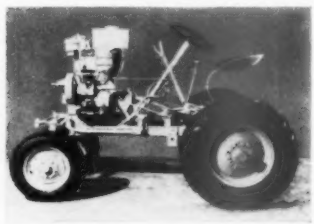
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.





walls, and up to the circulator again, RECO air circulator is said to keep all the air in a room in motion, without direct drafts. Made with 12-, 16-, 20-, and 24-in. propellers, unit has three speeds and is available in table, pedestal, or ceiling mountings. Reynolds Electric Co., 3000 River Rd., River Grove, Ill.

•



Tractor

Intended for heavy-duty hauling and for use in yards where inclines and uneven or muddy surfaces present problems, diesel-powered tractor may be converted for use in stock-piling loose materials, and for snow removal, mowing, or light grading. One-cylinder air-cooled engine develops 5.4 hp. at 2000 rpm., operates at full load for 3 hours on a single gallon of No. 2, 3, or 4 furnace oil, according to maker. Overall length of 7 feet and 4-ft. 6-in. width permit turning in less than 10-ft. radius. R. H. Sheppard Co., Hanover, Pa.

•

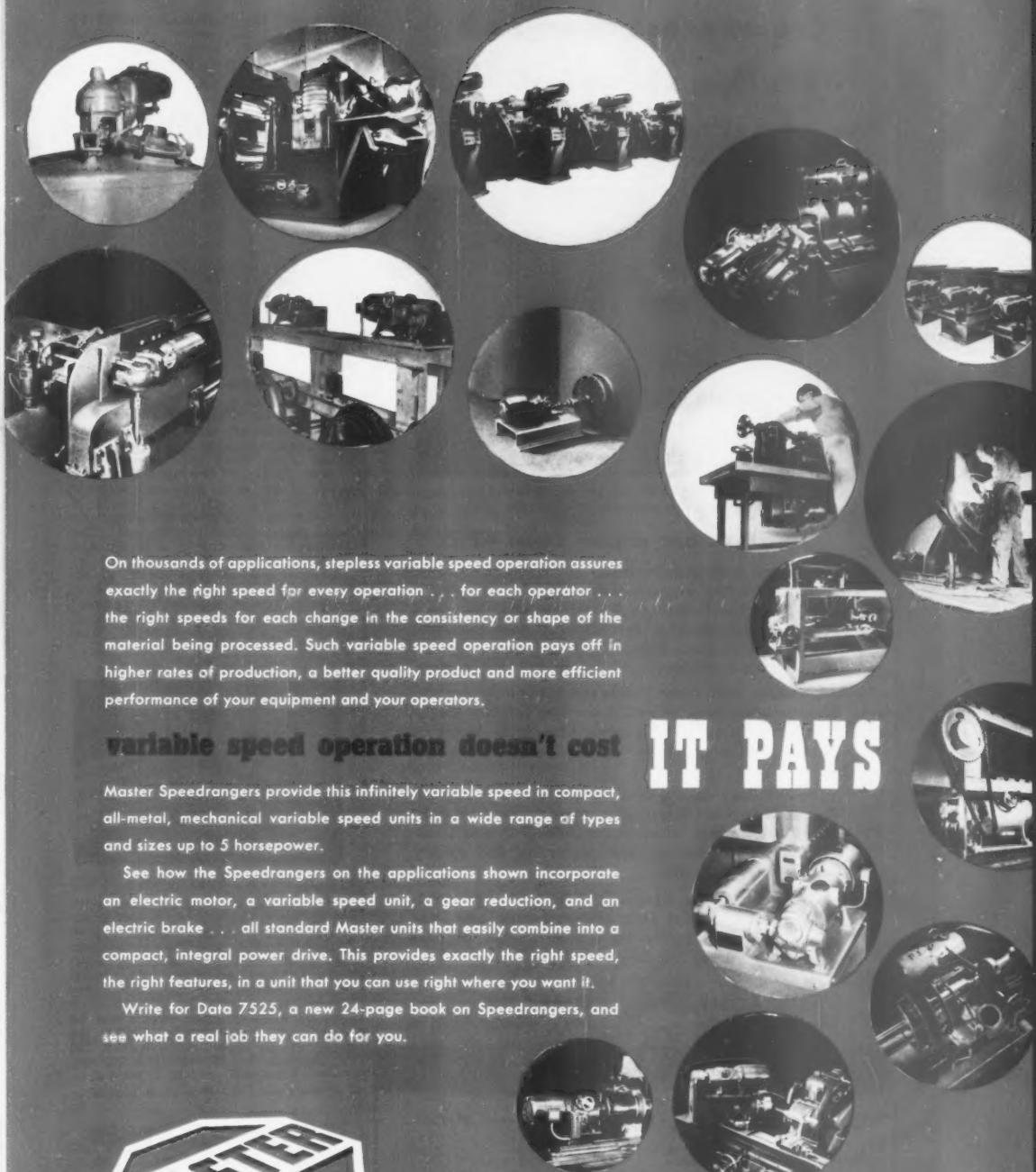
Band Saw

Three-piece cast-iron design of 12-in. band saw, BW 740, is said to minimize vibration and distortion. Adjustable cushion tensioner protects blades from shocks. Guides have split-leaf blocks set at 45 degrees to provide support close to work, with low friction loss. Dimensions are 12 inches, blade to frame; guide to table, 7 inches maximum. Rip fence, mitre gage, stand, motors, and other attachments can be furnished. Walker-Turner Div., Kearney & Trecker Corp., Plainfield, N. J.

•

Air Conditioner

Gas-fired winter air conditioner of the high-boy type occupies a 2-ft.-square floor space, is 4½ feet high, delivers 57,600 Btu. at the bonnet. Twin blowers circulate air directly up both sides of heat exchanger. Heating element is constructed of



On thousands of applications, stepless variable speed operation assures exactly the right speed for every operation . . . for each operator . . . the right speeds for each change in the consistency or shape of the material being processed. Such variable speed operation pays off in higher rates of production, a better quality product and more efficient performance of your equipment and your operators.

variable speed operation doesn't cost

IT PAYS

Master Speedrangers provide this infinitely variable speed in compact, all-metal, mechanical variable speed units in a wide range of types and sizes up to 5 horsepower.

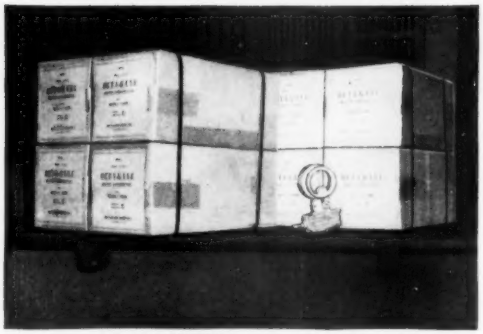
See how the Speedrangers on the applications shown incorporate an electric motor, a variable speed unit, a gear reduction, and an electric brake . . . all standard Master units that easily combine into a compact, integral power drive. This provides exactly the right speed, the right features, in a unit that you can use right where you want it.

Write for Data 7525, a new 24-page book on Speedrangers, and see what a real job they can do for you.

MASTER SPEEDRANGERS

THE MASTER ELECTRIC COMPANY · DAYTON 1, OHIO

Cut express charges by bundling shipments with ACME STEELSTRAP



THE TEST SHIPMENT that proved a saving!
Four cartons bundled as an Acme Uni-Pak.

Read how one shipper saved 43%!

Octo-Gane carburetors, made by Exola Products, Inc. of Los Angeles, are packed for shipment in 5-pound cartons. Before an Acme Shipping Specialist suggested bundling 4 cartons into one package, Exola shipped them separately and was charged on the basis of a 10-pound minimum for each carton.

Bundling with Acme Steelstrap made a big saving! In a cost comparison test, 4 cartons shipped singly cost $4.01 in express charges. The Acme Uni-Pak bundle of 4 cartons cost only $2.26—a cash saving of 43%!

This money-saving idea might well be applied *right now* to your shipping operation. But it is only one of the ways in which Acme Steelstrap and Unit-Load Band are saving time, materials, and money for thousands of users.

Acme Shipping Specialists know other cost-cutting solutions for your shipping problems. Ask for a free analysis—or for a free booklet of case studies—by using the coupon below.

STRAPPING DIVISION
ACME STEEL COMPANY
NEW YORK 17 ATLANTA CHICAGO 8 LOS ANGELES 11

ACME STEEL COMPANY, Dept. FM-79
2838 Archer Avenue Chicago 8, Illinois

☐ Send free booklet, "*Savings in Shipping.*"
☐ Have representative call.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

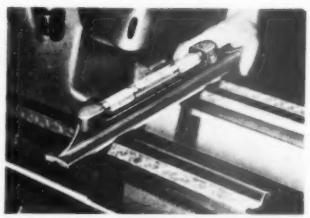
steel, and the cabinet is treated to withstand dampness. Armstrong Furnace Co., Columbus, Ohio.

•

Service Cocks

High-pressure lubricated service cocks, for working pressures up to 125 pounds on gas, oil, or water lines, are available in $\frac{3}{4}$- and 1-in. sizes. They have cast iron bodies, bronze plugs, and are made with both screwed recessed ends and Dresser super-service ends. Five layers of resilient packing cover the gland and hold the plug against its seat. The bottom of the cock is a continuous casting, and the top is closed by means of a screw-type bronze gland, requiring a special spanner wrench. This makes it practically tamper-proof, according to the manufacturer. Walworth Co., 60 E. 42nd St., New York 17.

•



Level

For use in leveling machine tools, 12-in. level has a ground and graduated vial mounted in a cast-iron frame. Base is precision-ground on all useful surfaces, including a V-way for leveling shafts. The spirit vial is mounted in the frame, protected from breakage by an aluminum alloy cylinder which may be revolved to completely enclose the vial. South Bend Lathe Works, 298 E. Madison St., South Bend 22, Ind.

•

Tension Wrench

Calibrated in both foot-pounds and centimeter-kilograms, tension wrench has a high limit of 100 foot-pounds, 150 foot-pounds with extension. A toggle action releases the

outstanding improvement in DIAPHRAGM VALVES by CRANE

NEW SEATING ARRANGEMENT
MORE DURABLE...
SAFER...MORE EFFICIENT

WORKING PRESSURE:
150 Pounds
water, oil, air or gas
180 Deg. F.
maximum temperature

Now, after completing exhaustive tests, Crane presents this better diaphragm valve—better suited for more services under today's working conditions. Stemming from basic improvements, such as the radically new bonnet-sealing and valve-seating arrangement, this original Crane design introduces many outstanding service features like those shown here.

1. LONGER DIAPHRAGM LIFE, because diaphragm is used *only* to seal the bonnet—not for seating purposes.

2. POSITIVE SHUT-OFF in case of diaphragm failure. This is an exclusive Crane safety feature.

3. ACCURATE SEATING—new flat face disc with durable, resilient seating surface assures tight closure on all fluids.

4. GREATER FLOW CAPACITY with reduced resistance and pressure drop, assured by Crane Y-pattern body design.

5. EASIER OPERATION—Crane separate disc and diaphragm construction takes less torque—fewer turns—to operate.

Valve Open

Valve Closed

HOW IT WORKS

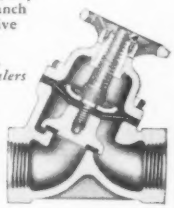
The Crane diaphragm serves one function only—sealing the bonnet. It is not subject to crushing and rapid wear. The seating member is a separate circular flat face disc, firmly attached to the stem and joined to the diaphragm with a special leakproof connection. This independent seating feature permits positive shut-off with no loss of fluid, even in case of diaphragm failure.

GET THIS DESCRIPTIVE CATALOG

See these new valves—the outstanding buy in their class—at your local Crane Branch or Wholesaler. Or write for descriptive catalog AD-1761.

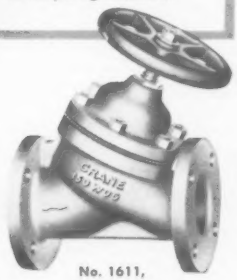
CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*

This new Crane line includes iron valves with screwed ends in sizes ½ to 2 in.; with flanged ends from ½ to 4 in. Neoprene coated valves—flanged ends only—in sizes from ½ to 4 in.



No. 1610, screwed ends

No. 1615, flanged ends, neoprene coated



No. 1611, flanged ends

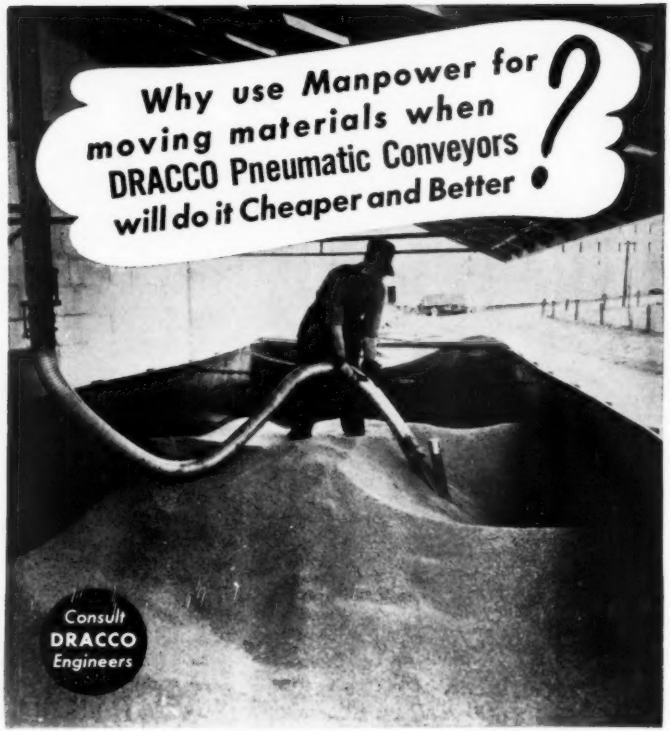
EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM


Why use Manpower for moving materials when DRACCO Pneumatic Conveyors will do it Cheaper and Better ?
Consult DRACCO Engineers

DRACCO Pneumatic Conveyors are economical for small as well as large operations. They move chemicals, grains and granular materials from receiving to storage in any part of plant, even up many floors. Materials may be moved from one building to another, under or over streets or railroad tracks. DRACCO Pneumatic Conveyors are CHEAPER and BETTER than manpower. In face of keen competition it is good business to make every possible saving. Why not consult DRACCO Engineers and have them check your present methods. They can probably save you money.

DRACCO CORPORATION

4091 E. 116th St., Cleveland 5, Ohio *New York Office:* 130 W. 42nd St.

DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

pressure when desired tension point is reached. Setting remains fixed (resets automatically) until changed manually. Intended for applications in which nuts or bolts must be tightened to specification. Sunnen Products Co., 7937 Manchester Ave., St. Louis 17.

•

Portable Power Saw

Stroke of reciprocal gun-type saw is adjustable up to two inches. Manufacturer states that it will cut through all materials, from rubber to stainless steel, without damaging the blade or mechanism. Special guides for various blade widths, from ½ to 1 inch, eliminate whipping or snapping of the blades, and serve as sights in following a line. Handle of the tool can be moved to any position to ease arm-fatigue when cutting at angles. Unit will swivel 360 degrees and lock in any cutting tangent. It can be driven by an electric or air drill, or by a flexible shaft. Transa, Inc., Dept. FMM, Suite 440-445 Gateway Bank Bldg., Minneapolis.

•

Ladder

Lightweight utility ladder, called Util-Ladder, holds on curved, flat, or irregular surfaces, as its side rails have rubber pads, are curved at the top to hold the ladder away from the supporting surface. May also be hooked over the edges of tanks or walls. Made of tubular steel; 6 feet high, weighs 12 pounds. Professional Mfg. Co., 333 S. Peoria St., Chicago 7.

•

Vibration Mount

Felt product, called Westsorb, is intended for use to eliminate vibration from all types of machinery.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

NOW...

LIFE-LINE slashes a-c motor upkeep costs

Here's how Life-Line motors can save you half the upkeep cost, and more.

A recent survey of 114 large motor users—operating 131,626 a-c motors of 1 to 50 hp—shows how much motors *really* cost when you figure actual "Life Cost".

The survey shows that the yearly average cost of periodically lubricated motors was $270 for every hundred motors installed.

On lubrication cost alone, Life-Line motors saved this $270. That's because Life-Line requires no periodic lubrication—no added lubrication of any kind.

The survey also indicates that the yearly outage cost per hundred motors, for repairs and lost machine and man-hours, was $960.

The record of 500,000 Life-Line motors in service, to date, indicates a failure rate averaging less than half that of conventional motors covered by this survey. This means over 50% indicated reduction in motor outage costs—in short, a possible saving of $480 per year with Life-Line.

Add these savings—$270 for lubrication plus $480 for outages—and the result is $750 per hundred motors per year.

Can you afford to pass up savings like these? Get the facts on the savings possible in your plant. Ask your nearby Westinghouse representative for a copy of B-4321 "How to Cut Motor Costs $750". Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21514

Westinghouse *Life-Line* Motors

Accurate batching . . . automatically controlled by Toledo Scales . . . helps to maintain unvarying quality in production of Bromo-Seltzer at the Emerson Drug Company, Baltimore, Md.

Shown here is part of the efficient production system of this plant. The dry, granular processed salt is fed to the bins by a belt operating in a stainless steel housing. The material is weighed into the portable hoppers shown on the scale platforms . . . with Toledo automatic controls cutting off the filling operation at precisely the desired weight.

Control your costs and quality with TOLEDO all the way . . . in weighing, counting, force-measuring, batching or testing. Send for new bulletin No. 2020. Toledo Scale Company, Toledo 12, Ohio.

Toledo Service as near as your telephone . . . with factory-trained service men in more than 200 cities of United States and Canada.

TOLEDO

HEADQUARTERS FOR SCALES

Made from uniformly blended wools, it is available in three densities and in ½-, ¾-, and 1-in. thicknesses. Western Felt Works, 4029-4117 Ogden Ave., Chicago 32.

•

High-Pressure Gas Gage

For testing high-pressure gases and liquids where the gages are subject to extreme pressures, instrument is constructed with a solid wall, cast integral with the case, separating the Bourdon tube and the movement section, to protect the observer from accidental rupture of the tube. The entire back of the case is fitted with a spring-mounted safety release, and in the event of accident, the plate will discharge the high-pressure media away from the observer. Device has deep-bushed stainless steel geared movements. U. S. Gauge, Div. of American Machine & Metals, Inc., Sellersville, Pa.

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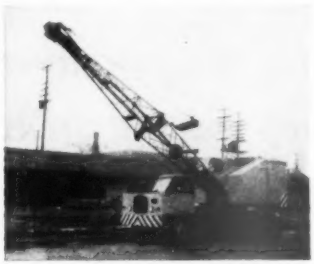


Truck Crane Carrier

Truck crane and carrier combination has a capacity of 20 tons. Minimum boom length for crane work is 30 feet; boom is extendible to 100 feet by the addition of intermediate sections. Outriggers extend the full width of the carrier. Rear outrigger trunk is demountable and makes possible changing from crane work to shovel, dragline, or pullshovel without repositioning the lower base for the crane. The Northwest Engineering Co., 135 S. LaSalle St., Chicago.

•

Cylinder Liner Puller

Model OTC No. 970 cylinder liner puller will pull both dry and wet cylinder sleeves on more than 200 makes and models of tractors and trucks, according to manufacturer.

New Du Pont Exhibit Room Shows
How Cordura* Rayon Delivers to Industry

A story of savings in reduced manufacturing costs and improved product performance is told by this display in the new Du Pont Rayon exhibit room at the headquarters of the Du Pont Company in Wilmington, Delaware. ★ Shown here are some of the products to which Du Pont "Cordura" High Tenacity Rayon contributes high strength . . . at low cost. Inherently stronger than natural fibers commonly used, "Cordura" also offers the advantage of unvarying uniformity. ★ Manufacturers are cordially invited to visit this exhibit room when in Wilmington.

HIGHER STRENGTH ··· GREATER FLEXIBILITY ··· LESS WEIGHT
"CORDURA" DELIVERS THE CARGO
"CORDURA" DELIVERS THE PUNCH
"CORDURA" DELIVERS THE POWER
This "Cordura" Carcass Designed to Carry 700 Tons Per Hour, 900 Feet Lifting 280 Feet
The "Cordura" Braid Controls the Pressure Operating Pneumatic Tools
Cords of "Cordura" Provide the Brawn of V-Belting. Each Belt Delivers 25 Horsepower

Hose bursting strength can be increased up to 50% because of the high strength of "Cordura" reinforcement. Or hose can be made much lighter, yet with far greater resistance to flexing, strain and internal friction. Because less "Cordura" is needed to attain a given strength, it enables significant reductions in raw material costs.

A conveyor-belt carcass reinforced with "Cordura" has high strength plus remarkable troughability. "Cordura" makes possible lighter belts that are easier to set up and work with. And, in addition, it provides the necessary tensile strength for long-lift belts that eliminate costly transfer points . . . helps give longer life.

Widely used in V-belts, "Cordura" has virtually eliminated "stretch." That means more power from each belt . . . fewer take-ups . . . less maintenance. And V-belts last much longer when they're made of Du Pont "Cordura" High Tenacity Rayon. More and more V-belt manufacturers are turning to this super-strong material.

*REG. U. S. PAT. OFF.

***For more information about "Cordura"**—or products made with it—write Du Pont. We'll be glad to give you a detailed analysis of any application you have in mind, along with other helpful data. Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.*

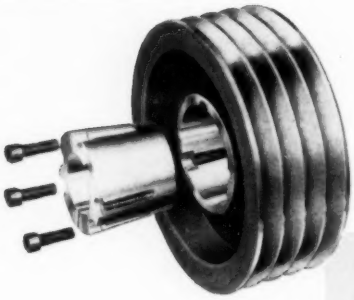
For Rayon . . . for Nylon . . . for Fibers to come . . . look to Du Pont

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

The simplest, surest mechanism ever devised for holding wheels to shafts

No flange—no collar. Easy on, easy off. Slip it on and tighten while sighting



Stocked in complete range of sizes in Dual Duty (A and B); B, C and D grooves

Holds fast to the shaft with firmness equivalent to a shrunk-on fit

A Great, Time-Saving Development—

TAPER-LOCK
Trade Mark

V-BELT SHEAVE

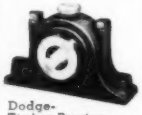
This is one of the century's biggest developments in power transmission equipment—another Dodge "first." Simpler, tighter-fitting, truer-running, infinitely easier to handle. Saves installation time and results in neater applications—in the plant or on your product.

Dodge's sole business is to "get the power through"—smoothly, steadily, economically. To succeed in this business Dodge has developed *many* products that are outstanding in the field of mechanical power transmission. Your Transmissioneer, the local Dodge Distributor, is equipped to give you valuable information on new and better ways to transmit power.

DODGE MANUFACTURING CORPORATION • MISHAWAKA, IND.

OTHER DODGE "FIRSTS"

Taper-Lock Flexible Coupling. Ready to install; no reboring.



Dodge-Timken Bearing. 4 basic types in a vast range of sizes.

Rolling Grip Clutch. No toggles! Flexible and positive.

DODGE of Mishawaka, Ind.

CALL THE TRANSMISSIONEER. Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

who states that it is adjustable to provide clearance regardless of the position of studs. Adaptor plates can be applied from the top. Owatonna Tool Co., 363 Cedar St., Owatonna, Minn.

•

Recirculating Pump

Capable of pumping 7 2/3 gpm. against a 2-ft. head or 2 2/3 gallons against a 10-ft. head, recirculating pump No. P-1 is powered by an enclosed shaded 2-pole 1/35-hp. motor. Suitable for evaporative coolers, coolant for machine tools, welders' tanks, etc. Operates on 115 volts a.c., uses 80 watts at 3100 rpm. Thermador Electrical Mfg. Co., 5119 District Blvd., Los Angeles 22.

•

Crane Scale

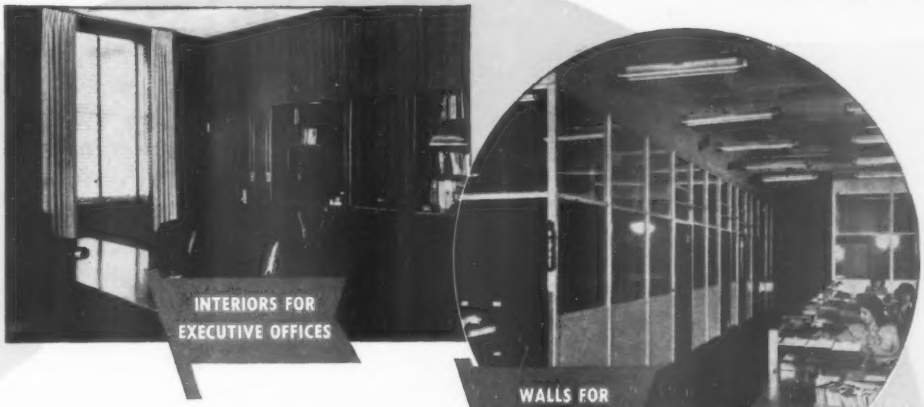
Line of hydraulic crane scales includes three models in capacities ranging from zero to 1000 pounds, to zero to 30,000 pounds. Designed primarily for measurement of loads handled by crane, scale may also be adapted for other force- and/or load-measuring operations. The A. H. Emery Co., Stamford, Conn.

•

Electric Drill

For drilling metal, wood, and composition, 1/4-in. electric drill, Model 425, is made with die-cast aluminum

From President's Office to Shipping Room...



Photographs courtesy of Nash-Kelvinator Corp.

HAUSERMAN *MOVABLE* STEEL INTERIORS meet every industrial requirement from the president's office to the shipping room. There are beautiful, distinctive Hauserman executive suites that are more soundproof than conventional tile and plaster construction. Bright and cheerful Hauserman general offices help promote efficiency and employee morale. And for the plant areas there are Hauserman *Movable* Steel Walls for isolating test rooms and supervisory personnel, and for controlling traffic, drafts and dust.

IN EVERY LOCATION, Hauserman *Movable* Steel Interiors assure efficient utilization of all floor areas for the life of the building. All Hauserman Steel Walls are quickly and easily moved whenever new floor layouts will promote operational efficiencies . . . often in a matter of hours. And whenever Hauserman products are moved, all units are completely re-used.

THERE ARE MANY REASONS why Hauserman *Movable* Steel Interiors are used in the smaller as well as the larger buildings in America. Among these advantages are: Rock-bottom Maintenance Costs–60 Beautiful Colors and Authentic Wood Grain Reproductions–Rigid Construction–Earlier Occupancy –Incombustible Materials–Ease of Adding Wires and Outlets–Ease of Servicing Utilities–Excellent Sound Control–Easy to Move.

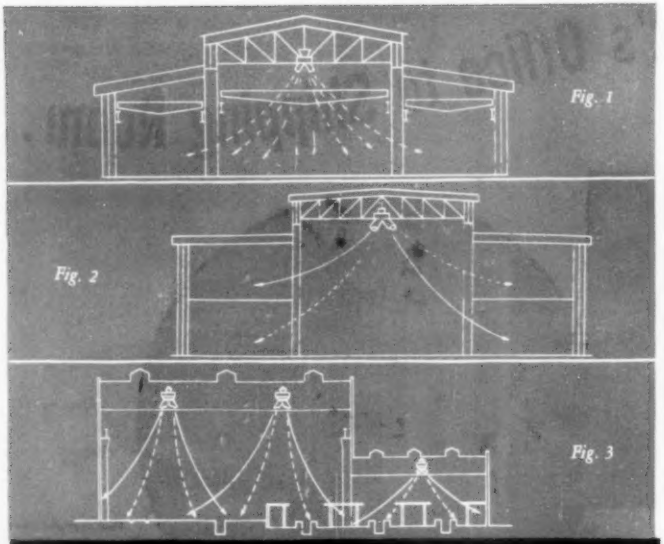
LET US HELP YOU with your interior wall and ceiling problems.

THE E. F. HAUSERMAN COMPANY
6751 GRANT AVENUE • CLEVELAND 5, OHIO
Branch Offices in Principal Cities — See Phone Book

HAUSERMAN
MOVABLE STEEL INTERIORS
WALLS • WAINSCOT • RAILINGS
ACOUSTICAL CEILINGS • COMPLETE ACCESSORIES
For every commercial, industrial and institutional need

***Specialists in Service*—We assume undivided responsibility for complete interiors . . . shop drawings, building measurements and installation. We supply all products complete with hardware, wiring raceways and accessories. Our experienced erection crews are on call for alterations and additions. Our engineers are always at your service.**

FREE CATALOG TO HELP YOU PLAN
You'll find *Movable* Steel Interiors to meet your exact requirements in Hauserman Catalog 49. Write for it on your business letterhead today.



Only Unit Heaters That Revolve Can Overcome These Heating Problems Efficiently and Economically

The Wing Revolving Discharge Outlets turn slowly through a complete circle about once every two minutes, affording complete coverage, avoiding concentrated blasts of air and providing a pleasant, healthful working atmosphere.

Illustrated above are three typical buildings which present heating problems that cannot be overcome by ordinary unit heaters with efficiency and economy. In Fig. 1, Wing Revolving Unit Heaters are located high in the center and out of the way of cranes. From this height they project the heated air slowly through 360 degrees, covering successively the central portion and the bays with equal thoroughness. The heated air moves around and under obstructions, reaching to walls and remote corners. Every part of the plant is thus kept at an even, comfortable temperature.

In Fig. 2, two floor levels are perfectly heated with only one line of Wing Revolving Heaters. This is accomplished by adjusting the discharge outlets so that one outlet covers the upper floor or balcony while the other covers the ground floor.

Fig. 3 is a railroad repair shop. This building is perfectly heated despite the massive obstacles, repair pits, etc., in it.

For further details write for Bulletin HR-5.

L. J. Wing Mfg. Co.

162 W. 14th St., New York 11, N. Y.

Factories: Newark, N. J. and Montreal, Can.

Manufacturing Licensee for Wing Unit Heaters in Western Europe—WANSON
9, rue Mogador, Paris 9e, France
222, rue Royale, Brussels, Belgium

Wing

Revolving UNIT HEATERS

frame, universal motor, and Jacobs 7B geared chuck, with chuck key permanently attached to cord. Standard model operates on 115 volts, 25-60 cycles; 220-volt model on order. No-load speed is 2200 rpm. Cummins Portable Tools, Div. Cummins Business Machines Corp., 4740 N. Ravenswood Ave., Chicago 40.

•

Induction Heater

Using vacuum condensers as well as vacuum power tubes, portable induction heater, called Sieco, may be used for soldering, brazing, and hardening jobs. All controls are located in upper quarter of front panel, leaving center clear for work fixtures. Forced air cooling drives the air through top cowl away from the operator. Machine may be adjusted to any single-phase line of 200-250 volts. Equipped with heavy casters and jack studs at all corners to facilitate leveling and locking to floor. Sherman Industrial Electronics Co., 505 Washington Ave., Belleville 9, N. J.

•

Filters

Intended for use with air, gas, and light liquids, filters are designed to remove visible or microscopic solids, such as carbon and pipe scale; also water and oil. Each filter contains one or more Mandler diatomaceous filter candles, consisting of porous opal or colloidal silica. Manufacturer states that this material has a

Storm Sash on Mass Production with AMERICAN MONORAIL

"Hang-on" station with upper level track over the cleaning and painting operations shown in background.

● A well-known manufacturer of steel office furniture has successfully undertaken mass production of screen and storm sash. A continuously operated finishing department, with a capacity of 80 storm sash and component parts per hour, is made possible by a 300 foot manually operated American MonoRail Overhead Handling System. Of a staff of 60 personnel, only 5 are required in the finishing department. The American MonoRail system transports all the pieces from cleaning and priming tanks to paint dipping vats to ovens to storage. Manual operation was chosen because of the diversity in size and shape of the pieces being finished.

Trolleys travel to dipping station where air-powered drop section lowers carriers to floor-level paint tank.

From the simplest hand-operated unit to the most complicated fully automatic system, American MonoRail engineers can suggest a system best suited to **YOUR** problems.

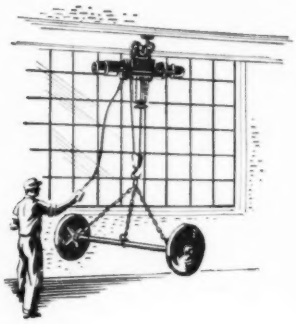
Finished sash travel through oven on monorail tracks which extend through rear door to stock bank.

SEND FOR BULLETIN C-1, a 36-page book showing successful applications of American MonoRail Systems.

THE AMERICAN MONORAIL COMPANY

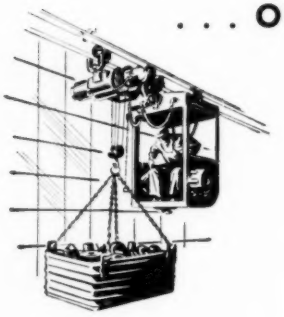
13114 ATHENS AVENUE **CLEVELAND 7, OHIO**

THEY LIFT THE SAME LOAD
BUT THEIR RUNNING COSTS DIFFER—



On the floor control, with the operator primarily occupied with other duties.

. . . OR



The operator in the cab, traveling loads at speeds up to 500 f.p.m. or more and occupying a better vantage point for spotting or stacking.

It's not always easy to forecast which type of service will best fill the bill.

Let the Shepard Niles specialist show you pertinent data on typical installations. He sells both types of hoist and overhead cranes as well, so he approaches your materials handling problem with an open, unprejudiced mind.

SHEPARD NILES
CRANE AND HOIST CORPORATION

Makes and sells all three lifting tools for airborne shop loads.

364 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

high rate of absorption, producing fine filtration. Available in a wide range of sizes and densities, they may be removed for cleaning and reuse. The Allen Industrial Filter Co., 25 S. St. Clair St., Toledo.

•

Electronic Counting Unit

High-speed electronic unit, Model 700 decimal unit, for counting, timing, and frequency measurement work, is a 4-tube plug-in unit measuring 5x5x1⅜ inches over-all. Contains scale-of-ten counting circuit capable of operating at rates in excess of 40,000 pulses per second and resolving pulse pairs spaced less than five microseconds apart, according to manufacturer. Units may be cascaded to count to any desired number, and may be reset to zero by opening a momentary contact switch connected to the bias supply. Berkeley Scientific Co., 6th & Nevin Ave., Richmond, Calif.

•

Materials Handling Attachment

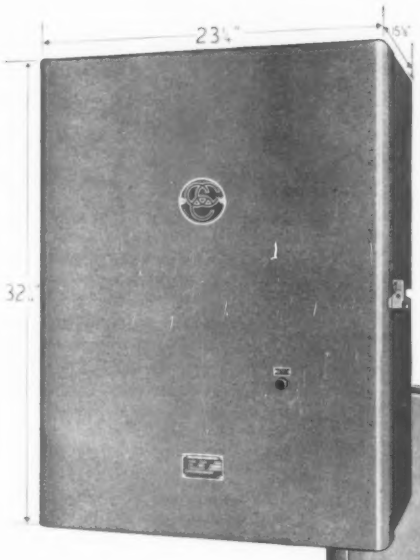
Developed to equip manufacturer's line of battery-powered hand trucks to perform odd handling jobs, work-saver attachment, called the Bunny-hugger, will handle bales of fabric, large crates, also pigs, according to manufacturer, without use of skids or pallets. Device has a capacity of 3750 pounds, grasps loads in a pincer-like movement, then lifts, transports, and tiers as required. Yale & Towne Mfg. Co., Philadelphia Div., 4530 Tacony St., Philadelphia 24.

•

Aluminum Ladders

Aluminum extension, straight, and special-type ladders range from 6 to 20 feet in length, with rungs ribbed for sure footing. Made of aluminum

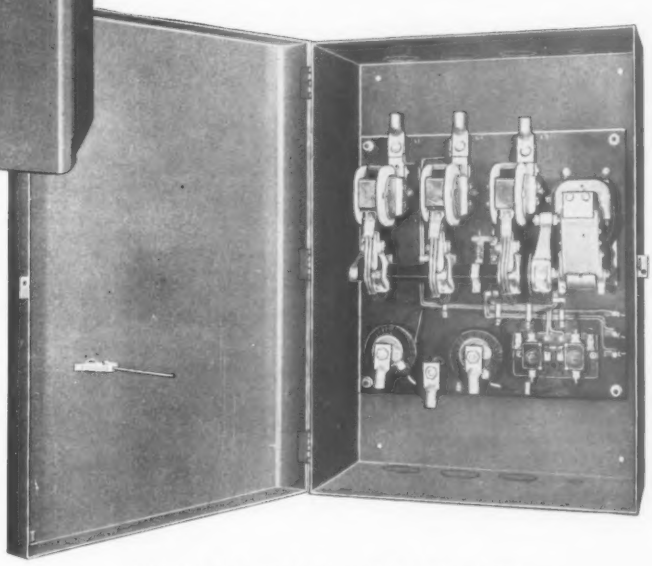
NEW! CLARK Bulletin 6013 Size 5 ACROSS-THE-LINE MAGNETIC STARTER



● Heretofore CLARK Size 5 Bulletin 6013 Starters employed Magnetic Overload Relays which had to be set to specific motor characteristics in our plant.

This Starter has now been re-designed to employ the well-known CLARK Bulletin 7322 Thermal Overload Relay, which can be set, in the field, to various motor characteristics by simply changing standard heaters.

The use of this Thermal Overload Relay is accomplished by means of "Do-Nut" type current transformers mounted on the load terminals, as clearly shown in the illustration.



The sturdy Bulletin 7700 Contactor, Overload Relay, and Current Transformer are mounted on a 1" x 20" x 21" slate panel, and enclosed in an attractive NEMA Type 1 cabinet. Other type cabinets will be available—all providing plenty of wiring space and clean-cut knockouts, top and bottom.

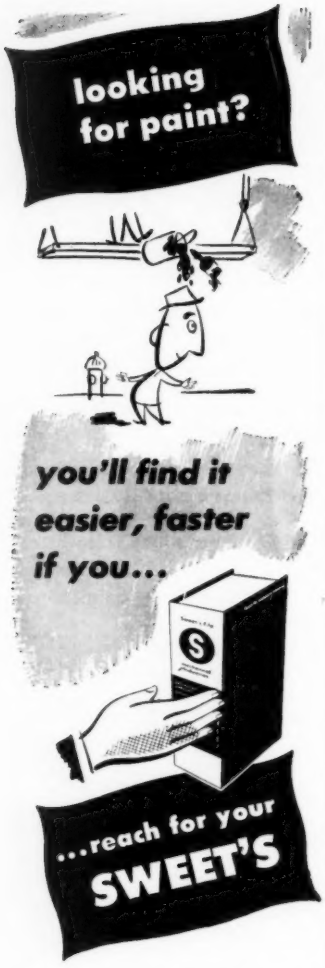
These newly designed Size 5 Starters are now carried in stock.

This new design of starter will soon be incorporated in CLARK Bulletin 6013 Combination Starter, which includes both Starter and Safety Switch in one cabinet, either fusible or non-fusible.

Available through your Clark Distributor.

THE CLARK CONTROLLER CO.

EVERYTHING UNDER CONTROL • 1146 EAST 152nd STREET, CLEVELAND 10, OHIO



When you need specific information on materials, equipment or services reach for your Sweet's File for the Mechanical Industries (the big black file). It contains 197 manufacturers' catalogs full of useful information on thousands of products . . . from abrasives to zeolite. Cross indexing speeds finding.

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119 W. 40th ST., NEW YORK 18, N. Y.

tubing, they are rounded on the top, and have heavy-duty, solidly inset rubber feet. Zero-Lite Products, Dept. 200, 317 Sherman St., Chicago.

•

Fluorescent Light

Developed to provide intense but cool and glare-free illumination for critical work areas, Model 10 Miniature fluorescent lighting fixture is available with a choice of support-arm lengths and arrangements. Provides light intensity of 550 foot-candles at a 3-in. working distance from twin 4-watt lamps; also available for use with ultra-violet (black light) or for direct attachment to 4-in. junction boxes for permanent and enclosed installations. Stocker & Yale, Marblehead, Mass.

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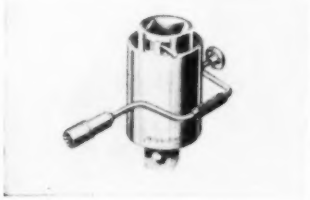

Ratchet Adapter

Compact design of ratchet adapter is said to permit ratchet action in limited quarters. It may be used with any of manufacturer's ½-in. square drive handles or attachments. Made from alloy steel, it is 2 9/16 inches long, with a diameter of 1¼ inches. J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.

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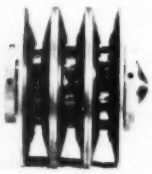

Variable Pitch Sheave

Sheave, called the Maxi-Pich, is said to be adaptable to all industrial equipment. Interlocking splined surfaces at the bottom of the groove make possible maximum pitch diameter variation approximating 250 per cent of the width of the belt section, according to maker. Pitch is varied

WATER

ALWAYS GOOD *and* COOL *with* fedders ELECTRIC WATER COOLERS

● Fedders complete line of Electric Water Coolers provides popular sizes for office and plant use. Thousands of Fedders-built Electric Water Coolers in operation in every climate in every part of the world.

Fedders cabinets are finished in satin metallic gray. They occupy floor space less than 16" square.

Fedders construction using Monel, Everdur and hot tin-alloy dipped copper water lines and tank meets sanitary codes.

Tested and rated in accordance with all requirements of U. S. Bureau of Standards, CS 127-45. Approved by Underwriters' Laboratories and Canadian Standards Association. Meets requirements of National Electrical Manufacturers' Association and National Board of Fire Underwriters.

Write for full information.

★ ★

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fedders

Varies Speed *WITHOUT STOPPING*

Another *Texrope* Engineering Triumph!

- Instant speed control at lower cost than ever before
- Covers most speed changing needs from 3 to 20 hp
- Extremely simple — one sheave does all
- Infinitely variable speed — 200% range

SIMPLEST, most economical method of instant speed control ever devised. Simply move motor forward to increase speed and move it back to decrease. The new *Vari-Pitch* Automatic Sheave changes pitch diameter and holds belts at proper tension automatically. All other parts of the drive are standard *Texrope* V-belt drive components.

For details see your A-C Authorized Dealer or Sales Office or write for bulletin 20B7223. *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

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Sold . . .
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MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters, push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

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MILWAUKEE, WIS.

ALLIS-CHALMERS

Do you recognize these HOLTITE fastenings? Guess what industry uses each of them. Check yourself by the list below.

CONTINENTAL makes them all and thousands more

Of all the 400,000 varieties of fastenings that literally hold our industries together, Continental makes a large proportion marketed under the famous HOLTITE trade name. Most of them are standard — screws, nuts, and bolts for every use in every industry. Others like the well-known HOLTITE-Sems and HOLTITE-Phillips screws are patented specialties and the famous HOLTITE-Thredlock, Locktite and Tap screws were first designed and produced by HOLTITE. Sometimes a fastening engineered by HOLTITE for one industry finds an unexpected use in another. Often a HOLTITE-*Engineered* fastening will replace several parts that a manufacturer is using. Why not discuss your fastening requirements with a Continental Sales-Engineer. He will focus on your requirements all the broad industrial-fastening experience and ingenuity of Continental. Remember Continental is constantly improving HOLTITE products, lowering their cost and broadening service.

ENGINEERED FASTENINGS FOR PRODUCT ENGINEERS

A. This chrome plated Phillips screw used on passenger guard rails in busses has a special shaped head to dress up appearance and provide additional shear resistance.

B. A special shoulder on this unusual HOLTITE Phillips motor bus seat adjusting screw assures snug, rattle-free fit between vehicle body and driver's seat.

C. The Phillips head on this special HOLTITE-Sems bolt speeds initial driving. The hex head allows use of a torsion wrench for final adjustments and repair in the field. This unique design cuts assembly time on truck chassis by several minutes.

D. An example of a HOLTITE "Lock-Tite" screw. The screw and lock washer come in one solid piece. With but one part to handle, assembly steps up and waste drops to a minimum.

This Trademark HOLTITE T. M. REG. U.S. PAT. OFF. *means made by —*

CONTINENTAL SCREW COMPANY

1904 NEW BEDFORD, MASS., U.S.A. 1949

by means of a handwheel, and friction lock is accomplished by tightening one screw. Constant belt alignment with a standard motor base, interchangeable steel hubs, and utilization of a standard V-belt companion sheave are features of the device, which is available in six different pitch ranges, two each in belt sections A, B, and C. V-Belt Engineering Co., Aspen Ave., Richmond, Va.

•

Socket Wrenches

In order to increase the utility of line of Proto socket wrenches, 12 new models have been added, ranging from a ¼-in.-drive 8-point (double square) socket with ⅜-in. opening, to a ½-in.-drive 12-point socket with ⅜-in. opening. Two are screwdriver sockets. Plomb Tool Co., 2209A Santa Fe Ave., Los Angeles 54.

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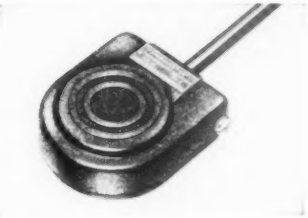

Foot Switch

Small, sensitive, treadle-type foot switch may be used with electric mangles; riveting, stapling, and fastening machines; intercommunications systems and signaling devices; and similar equipment. Made of heavy-gage steel, with a cork composition non-skid base; weighs 6½ ounces. Simonds Machine Co., Inc., Southbridge, Mass.

•

Tractor

Featuring a 25-hp. D140 valve-in-head engine, tractor, called the Centaur CI, is said to have a high power rating. Manufacturer claims that low piston speed and replaceable wet sleeve liners provide durability and minimum maintenance, and that ample clearance is allowed between the seat and full-crown fenders for high-lug snow or mud chains. Attachments include loader, backfill blade,

your COAL STORAGE PROBLEM

Fits Into ONE of These Pictures...

Wherever you are located, whatever space you have available, however much capacity you need . . . one of these four basic types of G-W Coal Storage Systems should fit your requirements.

The difference between a good and a poor coal handling system is in the *application* of proved engineering principles acquired through experience plus common sense and the integrity of the manufacturer. Gifford-Wood has designed each of the four types shown on the basis of a definite application for geographical location, available space and initial cost per ton of available storage.

G-W *knows* how to meet such conditions, and applies 140 years' of experience to the design of coal handling and storage systems for steam generating plants. Then the *one* right system is fabricated and installed under *one* contract, *one* delivery schedule and *one* responsibility.

Gifford-Wood's engineering service is available to consultants, engineers and plant owners at no obligation. Get in touch with a G-W engineer today.

GIFFORD-WOOD CO.

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● Where the rate of production and the quality of a product is affected by a cooling process, the NIAGARA AERO HEAT EXCHANGER with "Balanced Wet Bulb" Temperature Control has a remarkable performance record.

For example, by closer control of a quenching bath, it has helped make possible continuous production of precision parts with rejections reduced to the vanishing point and production over double previous performance.

Other applications are cooling of process equipment and engine jacket water, cooling of lubricants, cutting oils, hydraulic oils, electronic sets, transformers, controlled atmospheric processes, condensing of steam, gases and refrigerants, compressed air and gas cooling.

Write for further information and examples of applications in the field that interests you most.

Ask for Bulletin 96

NIAGARA BLOWER COMPANY

Over 30 Years of Service in Industrial Air Engineering

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District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

snow plows, rotary sweeper, utility boom, and winch. Le Roi Co., 1700 S. 68th St., Milwaukee.

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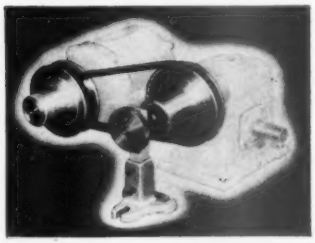

Variable Speed Control

One- or two-horsepower, 6:1 ratio variable speed control uses standard "B" belts, with fixed centers at any distance. Assembly includes two variable-pitch sheaves and control, and is adaptable to remote control. The sheaves may be obtained separately for V-belt to flat pulley drives. Speed Selector, Inc., 118 Noble Court, Cleveland 13.

•

Tool Balancer

Designed to eliminate lost motion by keeping tools in working position, tool balancer will handle tools weighing from 10 to 500 pounds, operates on 100-lb. air-line pressure. Device may be hung from a fixed point or operated on a standard 4- or 6-in. I beam, Cleveland Tram-rail, or American Monorail. It will swivel from zero to 17 degrees and will rotate 360 degrees. The Platz Co., 20433 Sherwood Ave., Detroit 12.

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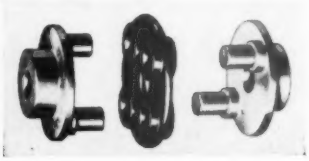
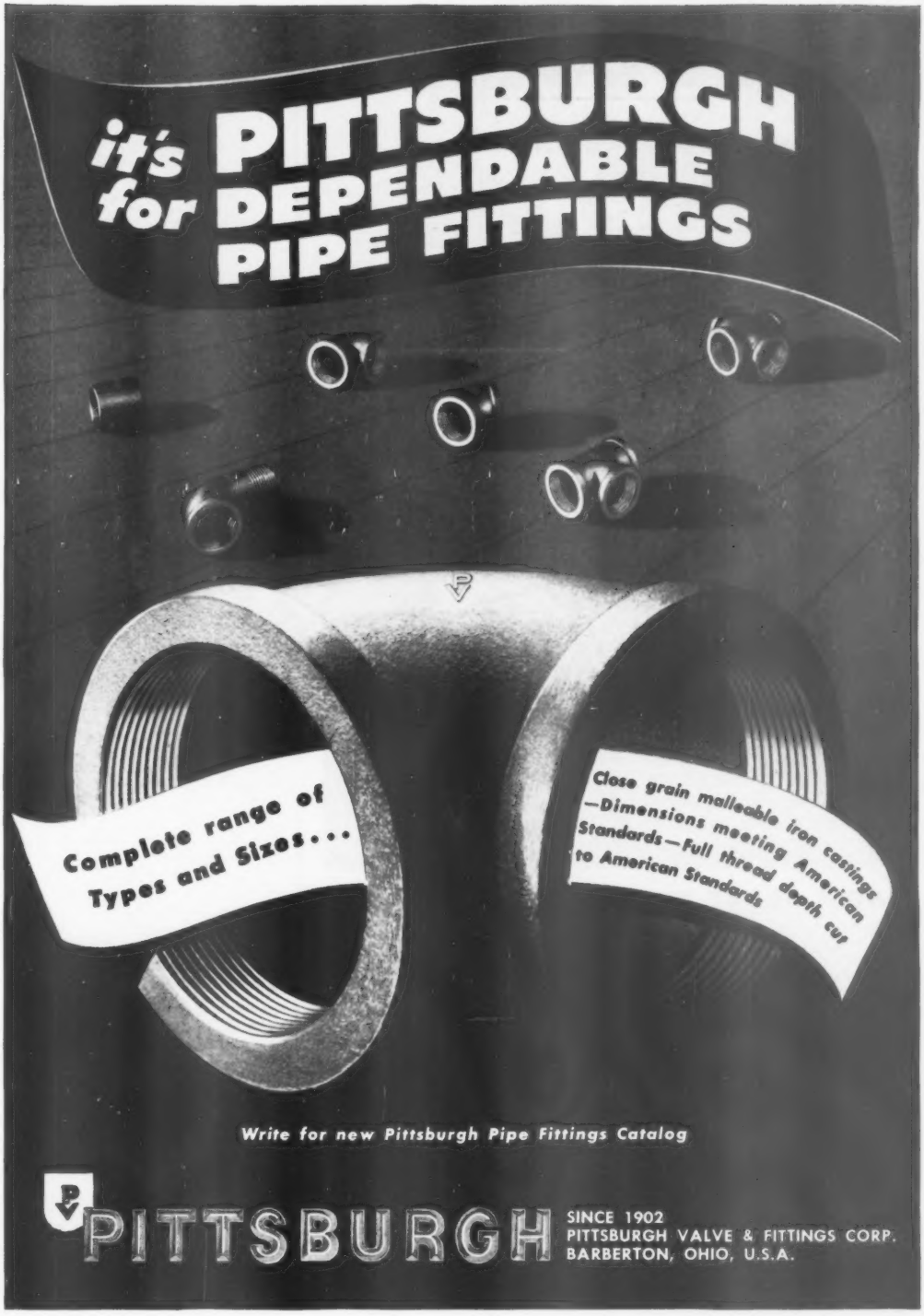


Coupling

All-rubber-center coupling, called Mighty Midget, is designed for power transmission with fractional-horsepower motors. Flexing caused by misalignment is absorbed by a Neoprene center member, according to manufacturer, who states that tight fit of the coupling pins when pressed


it's PITTSBURGH for DEPENDABLE PIPE FITTINGS
Complete range of Types and Sizes...
Close grain malleable iron castings —Dimensions meeting American Standards—Full thread depth cut to American Standards
Write for new Pittsburgh Pipe Fittings Catalog
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SINCE 1902
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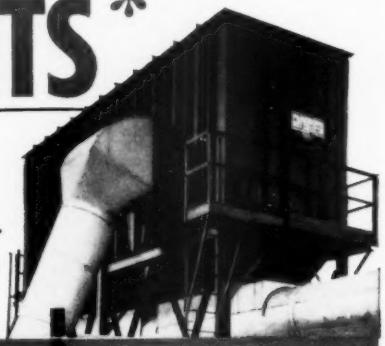
TURN DUST INTO PROFITS*



Hundreds of plants have done it... with Pangborn Dust Control!

*** PROFIT $13,951**

Pangborn Dust Control eliminates dust, pays for its operation, and *earns $13,951 each year* on charcoal salvage for this manufacturer!†

*** PROFIT $12,752**

In a large grain mill, Pangborn Dust Control eliminates dust hazards and *earns a profit of $12,752* annually, salvaging grain formerly lost as dust!†

*** PROFIT $7,691**

Based on operating costs before and after Pangborn Dust Control was installed, savings, other than salvage, for this metal plant *run $7,691 a year!*†

*** PROFIT $5,103**

Asbestos salvaged to the tune of *$5,103 yearly* . . . dust completely eliminated . . . that's the Pangborn Dust Control profit story for this Asbestos manufacturer!†

HOW ABOUT YOUR PLANT?

Let us make a "Dust Pocket" survey in *your plant*. There's no obligation! Pangborn engineers show you how the right Pangborn Dust Control equipment saves you money . . . boosts your profits! For full information and your *free copy* of Bulletin 909A on the control of industrial dust, write today to: PANGBORN CORPORATION, 282 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Dust Control Blast Cleaning equipment.

STOP THE DUST HOG from stealing profits with

Pangborn DUST CONTROL

into the rubber center eliminates noise and vibration. Morse Chain Co., subsidiary of Borg-Warner Corp., 7601 Central Ave., Detroit 8.

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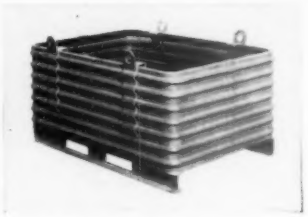

Steel Stacking Box

All-steel welded stacking boxes have corrugated sides and bottom, and are constructed with a 4-way entrance. Crane lugs, stacking brackets, and channel runners are optional. Boxes are built to specification. The Palmer Shile Co., 16007 Fullerton Ave., Detroit 27.

•

Bearing Extractors

For use in removing bearings or bushings from motor housings without damage, extractor set includes 17 plugs to take bearing sizes up to and including four inches, in graduations of $\frac{1}{8}$th inch. Spring extractor and 8-in. push-rod are included. Walco Electric Products Co., 131 Blackstone St., Providence, R. I.

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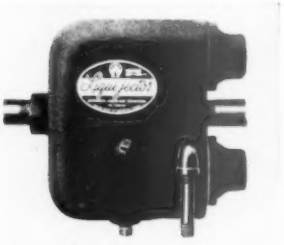


Filter-Cleaner

Water and water-oil emulsions, atmospheric dirt, and finely divided solid particles are automatically removed from compressed air or gas lines by device called Liquid-Jector. Unit may be used in pneumatic operations that require positive conditioning of air or gas, such as liquid sep-

BWH
DEPENDABLE RUGGEDNESS
BOSTON WOVEN HOSE & RUBBER CO.
CONCORD
STEAM #10
BOSTON, MASS.
BWH
1. Tough, long-wearing, abrasion-resistant cover.
2. Asbestos braid insures maximum cover adhesion, and includes NEW type static conducting wire.
3. High-tensile steel wire for strength, for safety.
4. Heat & oil resistant tube

BWH WIRE BRAID STEAM HOSE CAN REALLY "TAKE IT"

HERE'S PROOF!

Tests in the field show our new Concord #10 Steam Hose is a star performer. It doesn't get stiff and brittle, as some hose does when saturated with scalding steam. It's easy to handle. It's next to scuff-proof, even when banged against machinery and yanked over rough surfaces. But somebody raised another question.

"What happens," they asked, "if this wire-braid hose should be accidentally run over by a truck?"

To answer that question, we deliberately ran a 30-ton truck over our new Concord #10. What did happen? Nothing! The hose kept right on with its trouble-free performance.

Naturally we don't recommend such treatment. But we do say it's compelling proof that our Concord #10 is the last word in sturdiness. Here's what makes this hose outstanding:

1. Same dependably strong, heat and oil resistant tube that has won fame for extra service in BULL DOG Steam Hose.
2. Braids of high-tensile steel wire, heat and pressure resistant.
3. Asbestos braid assures perfect cover adhesion, includes NEW type static-conducting wire.
4. Tough cover, specially designed to resist abrasion and high temperatures.

With these features, it's easy to see why the new Concord #10 meets every need for steam hose that withstands 200 lb. working pressure with SAFETY, does a real job in helping you cut maintenance costs.

☆ ☆ ☆

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems. We're specialists in solving them. Consult your nearest BWH distributor or write to us direct.

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

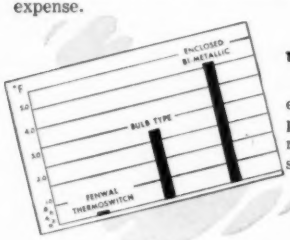
Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

An Actual Fact!...

3 Fenwal Thermostat Units Costing Less Than $25 Apiece Eliminate Instrument-Controlled Equipment Quoted at $18,000!

Instead of a costly, elaborate indicator-controller installation, a manufacturer selected three compact, easily installed Fenwal THERMOSWITCH* units for use with simple equipment designed with the assistance of a Fenwal engineer. Accurate, rugged and with contacts fully enclosed by the temperature-sensitive shell, these Fenwal precision thermostats are giving complete satisfaction . . . at a tremendous saving in original cost and maintenance expense.



THERMOSTAT OPERATING DIFFERENTIAL

In conventional temperature controls, differential is the result of backlash caused by moving parts. The THERMOSWITCH*, with no such moving parts, has a negligible differential as shown in the chart.

As in this solution to a problem of temperature control of dies in the synthetic-filament industry, you too may make amazing savings in heat control.

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THERMOSWITCH*

*Reg. U. S. Pat. Off.

The Precision Thermostat For Temperature Control and Over-and-Under-Heat Detection

SENSITIVE . . . *but only to heat*

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☐ Ovens
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☐ Liquid baths

OTHER (Please fill in your special requirements) .....

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aration, agitation, drying, spraying, etc. Three sizes are available, ranging from 0.5 to 2.5 gallons per 24 hours. Selas Corp. of America, Erie Ave. at D St., Philadelphia 34.

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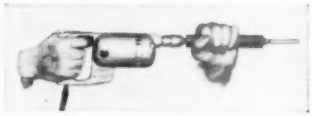

Hammer Attachment

Called Pow'r-Ham'r, attachment is said to turn an electric drill into a hammer that drills through masonry or, with special equipment, chisels, rivets, chips, removes paint, etc. Weighs one pound, six ounces, may be operated with any electric drill or flexible shaft having ¼-in. or larger chuck capacity, regardless of speed. It will take ten sizes of drill bits. The Roto-Power Corp., 283 Greene Ave., Brooklyn, N. Y.

•

Air Circulator

Designed to pull up cool lower air and circulate it in all directions, air circulator is made in both close ceiling and suspended models and in combination with luminous bowl lighting fixtures. Complete cycle construction is said to provide good circulation without drafts or blasts of air. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo.

•

Electric Cord Reel

Model RI (Roller Industrial) electric cord reel is equipped with a roller outlet cable guide said to mini-

ONE OF TWO WAYS TO CUT BUILDING COSTS!

You can now greatly reduce erection time. Top-Speed Fastening* is a new and safer system of attaching roof and siding to steel frame. The system is so much faster than any other method that *the same number of men in the same time can apply twice as much material.*

Top-Speed Fastening* is a major development in building methods. It uses a new group of tools and new, patented drive screws. All work is done from outside. This is the great development because it eliminates hazardous interior scaffolding completely. Here is your big saving in erection cost. Can be used on new construction and for repair jobs.

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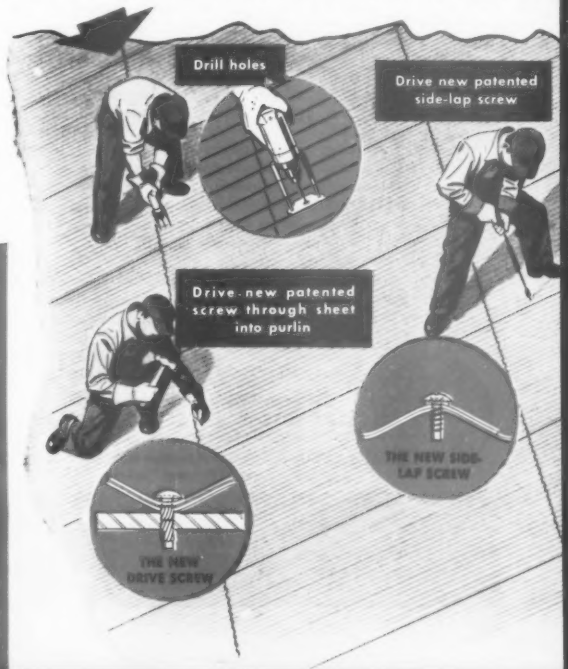
If you build with Top-Speed Fastening, the saving in time is so great that it pays for the labor of installing insulation. Therefore, if you need to insulate, you can insulate by the Robertson method for the mere cost of the material. Your own men can use these Top-Speed Systems. Tools are simple and very low-cost.

Write for Robertson's illustrated booklet showing the complete details.

*Patents pending

TOP-SPEED FASTENING SYSTEM


Drill holes
Drive new patented side-lap screw
Drive new patented screw through sheet into purlin
THE NEW SIDE-LAP SCREW
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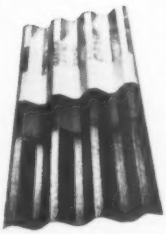
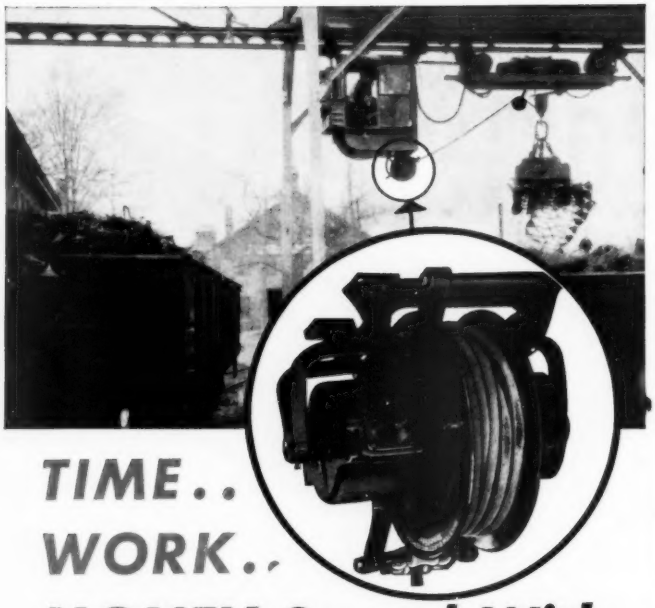
(The second way to cut building cost)



Galbestos is protected sheet steel unlike any previous protected metal. It cuts cost by saving materials. It requires fewer purlins, less structural steel and foundation materials. Galbestos is steel and asbestos, zinc-bonded, then impregnated with asphalt and waterproofed. This bond is so inseparable that Galbestos can be worked on ordinary sheet metal shop equipment in any way that unprotected metal can be worked. Galbestos has outlasted any comparable roofing and siding under the most severe weather, industrial heat and corrosion. It is unrivaled for durability. It comes in several corrugations in maroon or black. Tested and classified by Associated Factory Mutual Fire Insurance Co., and by Underwriters' Laboratories, Inc. Would you like to see samples? Write for Galbestos Catalog, telling how Galbestos saves construction cost. H. H. Robertson Co., 2418 Farmers Bank Bldg., Pittsburgh 22, Penna.



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WORK..
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APPLETON REELITE
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Prevents Kinks, Tangles, Breaks
In Conductor Cable

Moving electrical machinery operates smoothly and economically when power is supplied through Appleton Constant Duty Reelites. These sturdy, precision-built reels automatically take up and pay out conductor cable.

Operating on spring tension, Appleton Constant Duty Reelites hold cable gently taut, preventing breaks, kinks and tangles. Accidents are prevented, costly delays are avoided, work is speeded—cable costs are held to an absolute minimum.

To assure years of trouble-free service, springs of Reelites are enclosed in dust-tight, grease-filled compartments. Ball-bearings guard against wear, provide smooth, efficient operation.

Appleton Constant Duty Reelites are at work everywhere in industry—on hoists, lifting magnets, cranes, chargers, motor generator sets—an endless variety of machinery requiring flexible power supply. Thousands have profited through the use of Appleton Constant Duty Reelites. Why don't you?

Send for 50-Page Bulletin No. 504, giving complete details on Appleton Constant Duty Reelites, Portable Reelites, and Reelites especially built for air and fluid lines. Or see Sweet's File, page 2a 15.

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mize abrasion and prevent snubbing action of cable around the outlet. Built with internal lock and retrieving mechanism and swivel mounting bracket; can be installed on wall or ceiling. Heavy-duty handle designed for severe service. Reel is available in 25- and 45-ft. units equipped with a switch and side outlet and 30-in. plug-in lead. Aero-Motive Mfg. Co., 1803 Alcott St., Kalamazoo 24, Mich.

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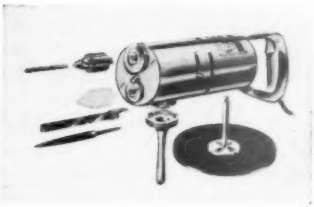


Portable Tool

Multi-purpose portable electric tool is designed for drilling, sawing, filing, sanding, polishing, etc., on either wood or metal. Three separate spindles, one of which provides a reciprocating stroke. Two spindle speeds are available, 2000 or 1000 rpm. Built-in trigger-switch controls the 110-volt universal motor. Smilan Tool Co., 2848 W. Pico Blvd., Los Angeles.

•

Timer for Hazardous Locations

For controlling electrically operated valves and motors where the atmosphere contains mixtures of gasoline, lacquer solvent vapors, or other explosive gases, timer, called Microflex, is said to provide timing accuracy of 0.1 of 1 per cent of full scale. Its cast-iron enclosure has a machined metal-to-metal seal making it suitable for use in Class I, Group D and Class II, Group G hazardous locations. Standard dials are 120 seconds, 20 minutes, 120 minutes, 20 hours, and 60 hours. Eagle Signal Corp., Moline, Ill.

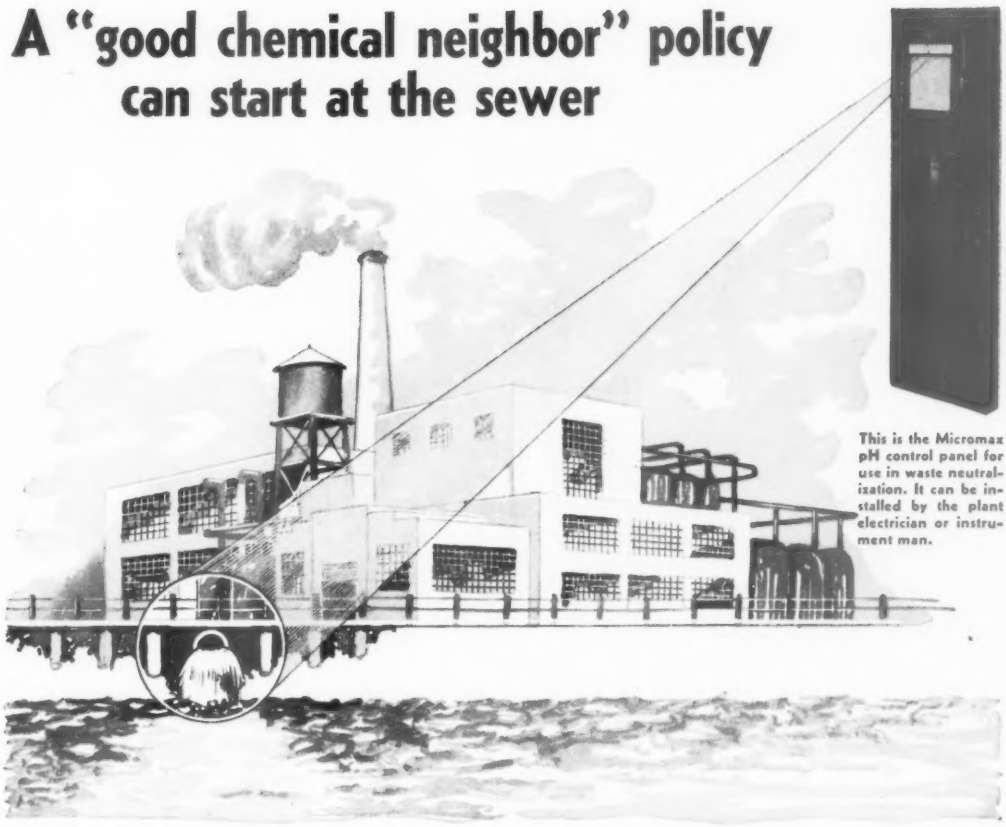
•

Rubber-Base Protective Coating

Called Lithogen, rubber-base protective coating is available in smooth or granular finish, for interior or exterior surfaces of wood, metal, masonry, or composition. It may also be obtained as a floor enamel for use on surfaces subjected to heavy traffic. Manufacturer claims that it resists ultra-violet rays, won't peel, and may be used on fresh plaster or concrete. It is a breather-type paint, will not lift off damp surfaces, and is fire-resistant, rust-, alkali-, and acid-resistant. Lithogel Corp., 10 E. 40th St., New York 16.

More information about "What's New in Equipment" on page 285.

A "good chemical neighbor" policy can start at the sewer



This is the Micromax pH control panel for use in waste neutralization. It can be installed by the plant electrician or instrument man.

THE sewer outfall marks the spot where a plant can prevent stream pollution, by discharging only wastes which have been properly treated. And, when proper treatment is linked to pH control, we can probably help . . . effectively. We can assist engineers to set up a good "chemical relations" . . . make the plant a good chemical neighbor.

Our contribution is through Micromax automatic pH control. Correct pH is often the definite assurance that plant wastes are meeting the requirements of good steam chemistry. We can tell you in just a few minutes whether pH on your waste neutralization system—either a present system or a contemplated one—can be controlled automatically; whether you can hold pH within prescribed limits.

Controllability analysis predicts actual results. Through long experience with pH control applications, we have developed a unique system of "controllability analysis." By scientifically weighing all pH control factors—type of waste, treating system, reagent—this analysis determines the net control effect possible for a given waste-treating system.

If you're planning pH control, you can't afford to miss this special service. Our catalog "Effective Neutralization of Industrial Wastes" explains controllability analysis in full detail. For your convenience, it also contains a simple questionnaire . . . so we can help you begin solving your plant's pH problems now. You can answer the questions in just a few minutes.

Ask for Bulletin ND44-96-708. *Address*

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Do YOUR piping systems include valve-killing services that build up excessive maintenance and replacement costs? If so, the new Jenkins Fig. 976-A Plug Type Bronze Globe Valve will produce important savings for you.

Install it where "wire drawing", due to close control of steam, knocks out other valves quickly—where entrapped chips, rust, or scale score the seats and start leaks. See how it defeats the worst valve enemies . . . how it sets new records for endurance and economy.

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The stout "heart" of the Fig. 976-A is the stainless steel plug and seat ring, *hard enough* (500 Brinell) to smash steel pipe chips without scoring, yet *tough enough* to take a nine ton load without cracking. Other features are . . .

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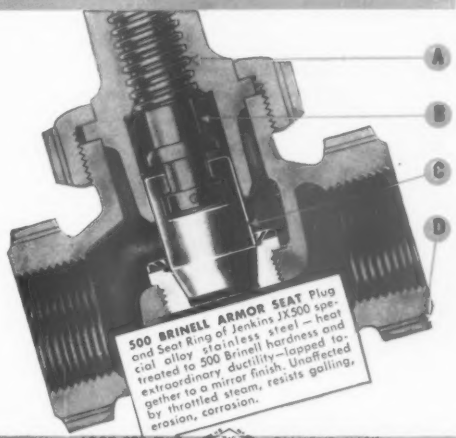
B **NEW "TUFFARD" SPINDLE**—Aluminum bronze (tensile strength exceeds 65,000 lbs.)—tough to take stresses, yet hard for long wear. Bigger in diameter, with more strong threads.

C **NEW SLIP-ON, STAY-ON PLUG**—Simple design with T-slot for engaging spindle head is stronger, trouble-free, and permits free flow. Mirror-finished bevel assures perfect mating with seat ring.

D **NEW STURDY LUGS**—Flat-faced, V-shaped lugs on union bonnet ring and body ends, permit firm fit and grip of open end, pipe or monkey wrench—withstand repeated disassembly.


A
B
C
D
500 BRINELL ARMOR SEAT Plug and Seat Ring of Jenkins JX.500 special alloy stainless steel—heat treated to 500 Brinell hardness and extraordinary ductility—lapped together to a mirror finish. Unaffected by throttled steam, resists galling, erosion, corrosion.

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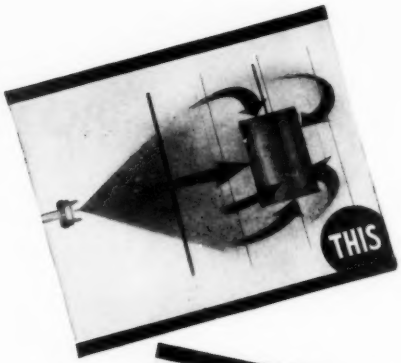

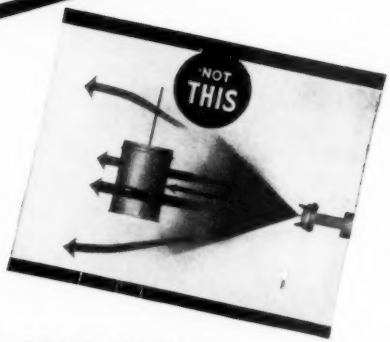

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In metalworking and woodworking plants everywhere, low-cost Delta-Milwaukee Machine Tools have long been recognized as the finest machines available.

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WM-26

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Magnesium is especially well adapted to the die casting process. In addition to extreme light weight, high strength and durability, magnesium die castings offer accurate dimensions, economy of machining, excellent surface finish, and low-cost quantity production.

SAND AND PERMANENT MOLD CASTINGS

Magnesium sand and permanent mold castings are used where light weight, high strength, resistance to shock, and good machinability are needed. Sand casting offers an economical method of producing small lots. Permanent mold castings should be considered for longer runs.

SHEET, STRIP AND PLATE

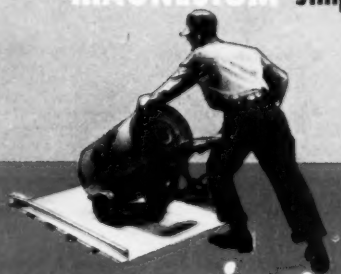
The high strength-to-weight ratio common to other forms of magnesium is found in magnesium plate, sheet and strip. This permits increased section thickness, rigidity and durability—plus a big weight advantage over other metals.

EXTRUSIONS

Magnesium is economically extruded into an almost unlimited variety of shapes, bars, rods and tubing. Many intricate special shapes can be extruded in magnesium, eliminating the necessity of forming operations or fabricating from standard shapes.

MAGNESIUM simplifies handling in the shop

Handling operations such as assembly, stock-piling, and packing for shipment can be done easier and faster with magnesium. The easy handling of this lightweight metal reduces fatigue, increases output, and lowers personnel hazards.



Magnesium Pays!

It pays to use magnesium from many production standpoints. Magnesium is a workable material—economically fabricated by well known shop techniques. Magnesium simplifies product design—makes assembly easier, less costly. And magnesium is appreciably lighter which speeds handling during production. Put magnesium to work in your plant—let it pay for you.

MAGNESIUM

MAGNESIUM is an excellent production material

MACHINING

Magnesium permits deeper cuts and higher feed rates than any other metal. It can be machined at maximum speeds of modern machine tools. The absence of any tendency to tear or drag gives excellent surface finish.

JOINING

Established and well-defined procedures are used in joining magnesium. All common methods including riveting, welding and brazing techniques are in commercial use.

FORMING

Distinct advantages result from the recognized practice of forming magnesium at elevated temperatures. Even deep drawing is done in one operation which eliminates the need for repeated annealing and redrawing with additional dies.

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The normally good stability of magnesium is readily improved further by a variety of protective finishing methods. Magnesium is adaptable to many decorative organic and electro-plated finishes.

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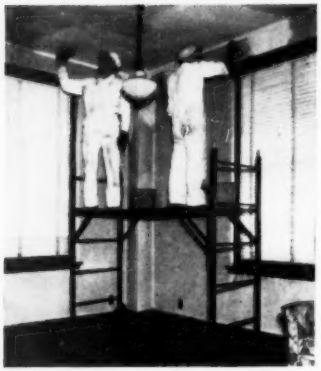

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more about the items on this page

Letters to the addresses given will bring you further information.

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LIQUID PLASTIC FINISH COAT called Phenoplast, bonds integrally with other material. Alcohol-, flame-, ink-, acid-proof; resistant to temperature extremes, abrasion, and wear. For metals, wood, paper, leather, tile, masonite, composition. Almost inseparable when used as glue on wood or metal. L. Sonneborn Sons, Inc., Bldg. Products Div., 88 Lexington Ave., New York 11.

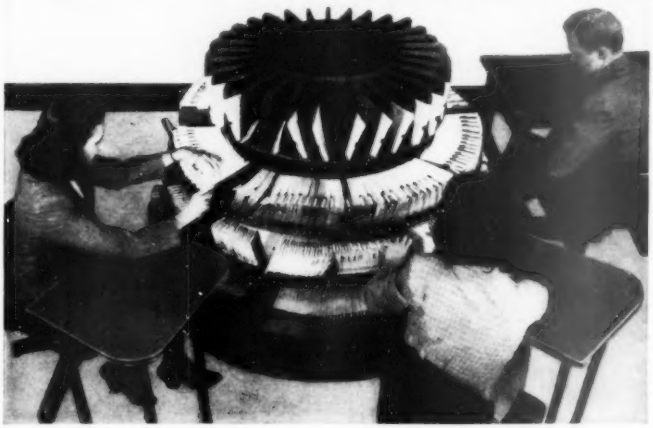
COUNTER for strands per inch in screen mesh, warp ends and picks, halftone dots per inch of half-tone, called Micro-Line Counter, consists of multiple layers of transparent plastic in metal frame, 6¼ inches long, 2¼ to 1¾ inches in width. Calibrations along sides show lines per inch and per centimeter. Micro-Lite Co., Inc., 44 W. 18th St., New York.

TEMPLATE provides true isometric ellipses projected from angle of 36°16', ranging in size from ¼ to 1¾ inches in small increments. Applicable to all axonometric drawing. Plastic, 5x10 7/16 inches; axes and

INSULATION. Plastic foam that expands to 100 times original volume when baked. Weighs less than meringue on pie, claims maker. Fire-, moisture-, fungus-, insect-resistant. Sample shown weighs approximately eight pounds. Westinghouse Research Laboratories, E. Pittsburgh, Pa.

sizes indelibly printed on face; punched for ring binder. Rapidesign, Inc., Box 592, Glendale Calif.

CEMENT all-purpose, bonds metals, plastics, glass, wood, rubber, leather, fabric, Formica, similar materials. Called Stabond C-111. Resists oils, gasoline, most acids, temperatures from —65 to +450 degrees F. One coat insulates against 1500 volts. May



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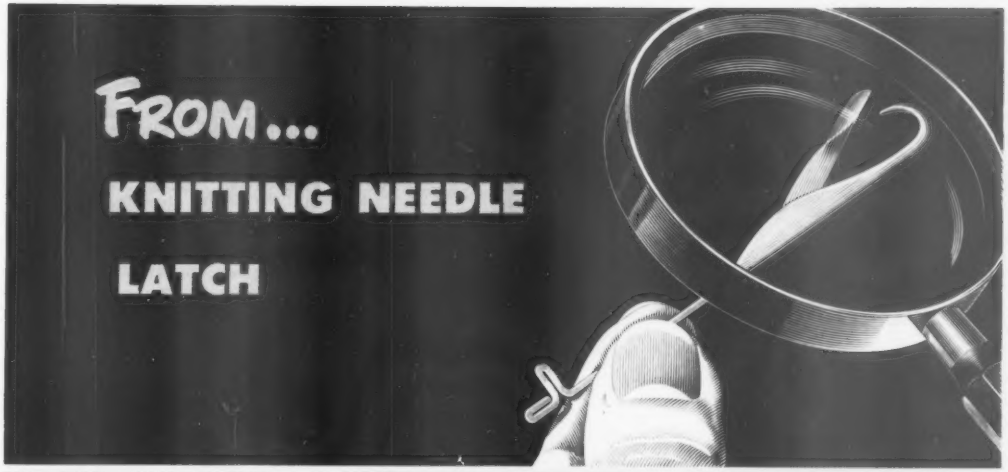

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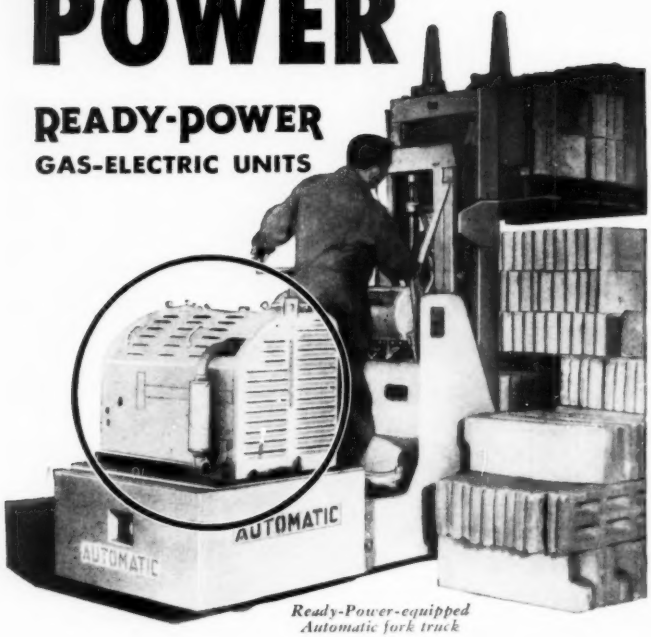

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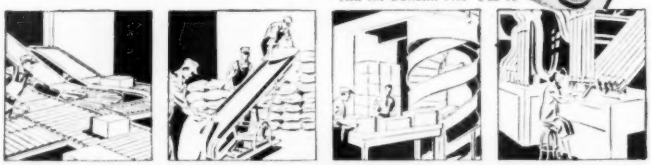

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FILMS:
Underground Arteries—The Story of Transite Pipe. Depicts the use, supply, distribution of water; steps in making, installing pipe. Full color, sound, 16mm.; 22 minutes. Johns-Manville, 22 E. 40th St., New York. *Molding on a Jolt Roll-Over Pattern Draw Machine.* Taken in an alloy foundry plant. 16mm., 22 minutes. Explanatory manual. Cooper Alloy Foundry Co., Hillside, N. J.

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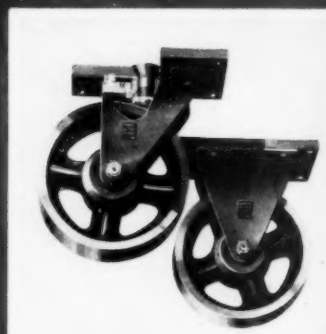

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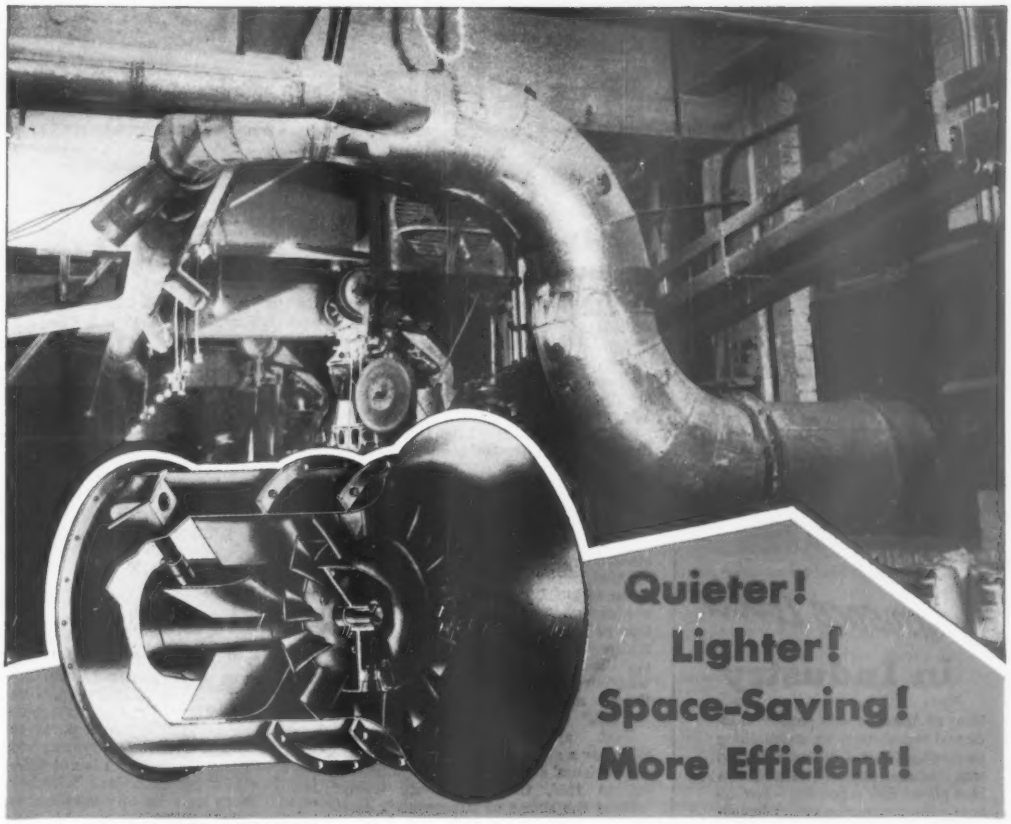

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SIGNIFICANT LABOR DEVELOPMENTS

BENJAMIN WERNE, Adjunct Professor of Industrial Relations, New York University and a Member of the New York Bar

Period Surveyed: May 1 to June 1

Labor Management Relations

INTERFERENCE

What is a protected expression of opinion or threat?

Statements by supervisors: "If the outfit went union, everything would be contracted out and we wouldn't have us a job." "Bet $100 that if the plant went union 100 men would be laid off."

It was held these could be threats and coercive, not opinions or arguments protected as free speech.

Test: All surrounding circumstances and that it purports to be opinion is not conclusive, although some evidence. "The substance and context of the statement, the position of the speaker in relation to his audience, are equally, if not more significant factors in determining whether a statement is free from any threat of reprisal of promise of benefit."

Test applied in determining whether a statement is free from any supervisors' statements is not whether, in fact, the statements were within the scope of supervisor's authority but "whether the employees have just cause to believe that the supervisor is acting for and on behalf of the employer in the situation under dispute." *J. S. Abercombie & Co.*, NLRB.

DISCRIMINATION

Where 46 rehired employees after layoff of 70 were, as disclosed by the record, equally prominent in union activity as six not rehired who charged discrimination, there was failure to establish disproportionate treatment of unionists for purpose of showing discrimination. *Quarles Mfg. Co.*, NLRB.

Defense of inefficiency, apathetic attitude, belligerency, insubordination, refusal to cooperate, refusal of job assignments, were held not sustained in the absence of evidence, particularly since the manager who made the discharge was present at the hearing but failed to testify. *Taylor Mfg. Co.*, NLRB.

REFUSAL TO BARGAIN

A petition for decertification of a certified bargaining agent was held no defense to a refusal to bargain where it fails to raise a question concerning representation because filed within one year of the certification. Certification is effective for one year and its effectiveness during that period is not exhausted by the fact that the contract with the certified union expired in less than one year from the date of certification. *Beldon Brick Co.*, NLRB.

Denial of Board jurisdiction and absence of a labor dispute with employees was held no defense of a refusal to bargain. *Hattiesburg Lumber & Supply Co.*, NLRB.

An employer's conditioning bargaining on the union's registration under state statute is illegal refusal to bargain. *Dalton Telephone Co.*, NLRB.

EMPLOYER RIGHTS

An employer has the right to petition for an investigation and certification of a bargaining representative even though the union had been previously recognized and was party to the contract, and the employer's good faith in filing the petition is not subject to attack by the union. Whether or not there may be any reasonable basis in fact upon which the employer might question the union's majority status is immaterial. In the instant case the employer raised the question of union majority status after the expiration of the last contract in response to the union's request for modifications of the contract. *Continental Southern Corp.*, NLRB.

EMPLOYER RESPONSIBILITY

A remark to an employee that he was "silly," "stupid," and "unwise" to remain in the union was held to be clearly an expression of opinion and as such protected by the free speech provision of the Act. *Tennessee Valley Broadcasting Co.*, NLRB.

An employer was held not responsible for coercive statements of a head machinist who was not a supervisor where such statements were not acquiesced in or ratified by the employer and it was not clear that employees considered such statements as reflecting the viewpoint of the employer. *Interchemical Corp.*, NLRB.

A company was held responsible for the anti-union conduct of the brother of the president because the

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"To protect the floors and simplify maintenance," would be a logical answer. However, these purposes can be served, and *still* the frequency of waxing can be reduced, by using *The Finnell Hot-Wax Process.* In this process, *Finnell-Kote Solid Wax* is used, and it is applied mechanically with *Finnell Equipment.*

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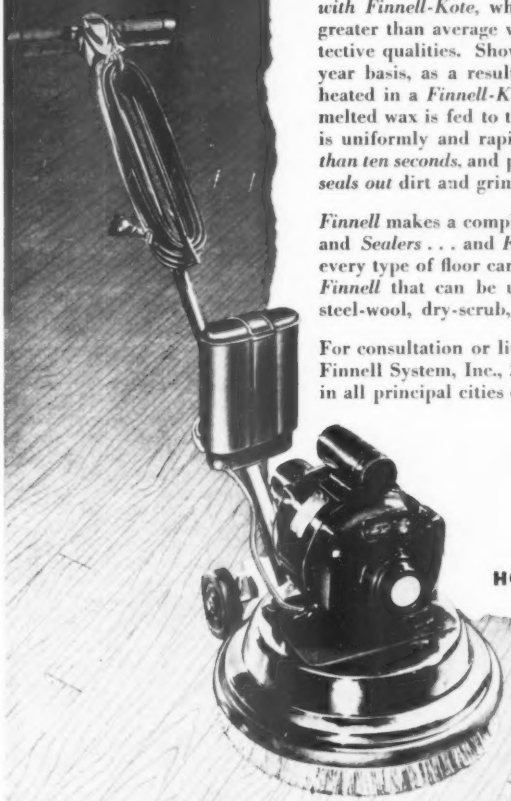

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LABOR DEVELOPMENTS *(continued)*

circumstances were such as to justify the employees' belief that he was a representative of the plant manager. On two occasions when he spoke about the union, the brother stopped operations, summoned employees from their work; two foremen who were present failed to interfere therewith, and the plant manager, on learning of such conduct, failed to disavow it. *Taylor Mfg. Co.*, NLRB.

APPROPRIATE UNIT

Single plant unit was found despite the functional connection with two or three other plants and the centralized supervison and personal hiring, where each plant had a superintendent with right to hire and fire, employees in the plant involved had a higher degree of skill and there was no interchange of employees. *Waldensian Hosiery Mills*, NLRB.

Single plant unit held appropriate because the second plant, 56 miles away, operated under separate supervision, had a different name, different brand product, and there was no history of collective bargaining on the broader basis, although there was some interchange of employees. *Georgia Fertilizer Co.*, NLRB.

Toolroom unit was established, and a crib attendant and toolkeeper were included therein, since they work in close association with such employees but do not have the same skill. *Signode Steel Strapping Co.*, NLRB. *Cribben & Sexton Co.*, NLRB.

Watchman employed solely for fire prevention purposes was held not to be a guard and may be included. *Georgia Fertilizer Co.*, NLRB.

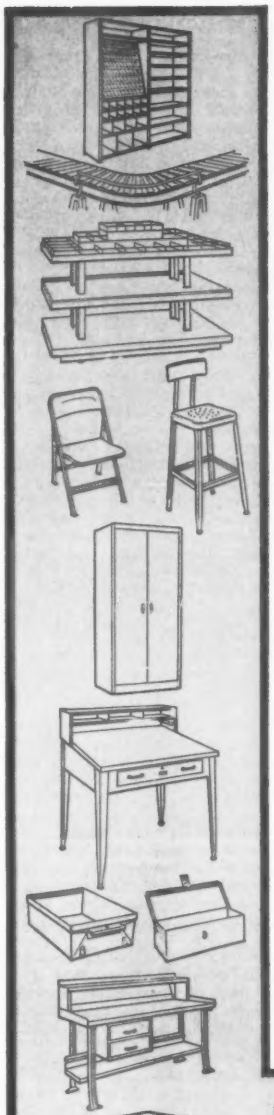
Professional employees: Employees in company's Pharmaceutical Development Division, all of whom have scientific degrees or their equivalent and work under a supervisor who is a professional, may constitute a separate professional unit. *E. R. Squibb & Sons*, NLRB.

Employees who work exclusively in foreign country are excluded from the bargaining unit. *Detroit & Canada Tunnel Corp.*, NLRB.

UNION SECURITY CLAUSES

The following types of contract clauses, dealing with union security, were held invalid and no bar to an election:

1. To hire only members of the contracting union whenever they are available.
2. To hire them through the contracting union.
3. When members of the contracting union are not available, to hire only individuals who are acceptable to the contracting union.
4. To require these individuals to obtain work permits from the contracting union before commencing employment.
5. To compel them to become members of the contracting union



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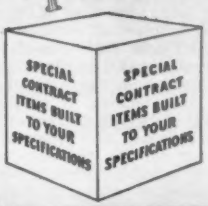

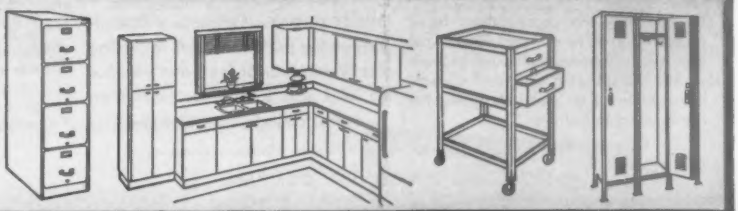

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- Drawing Tables
- Storage Cabinets
- Bench Drawers
- Work Benches
- Drawer Units
- Conveyors
- Shop Boxes
- Bar Racks
- Bin Units
- Tool Stands
- Service Carts
- Hopper Bins
- Parts Cases
- Flat Drawer Files
- Tool Trays
- Desks
- Stools
- Tool Boxes
- Sorting Files
- Ironing Tables

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Where cleanliness is of first importance as in food processing industries, Bradley Washfountains have become standard throughout the country.

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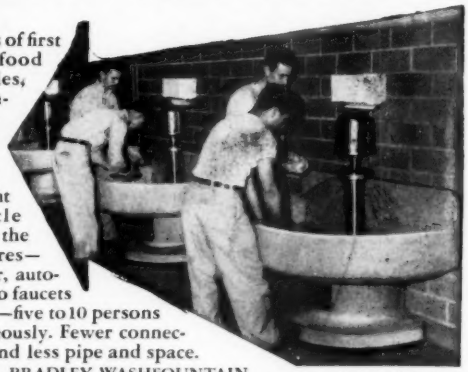

Partial View of Wall Type Bradley Washfountain Installation in Houston Packing Co. plant, Houston, Texas.

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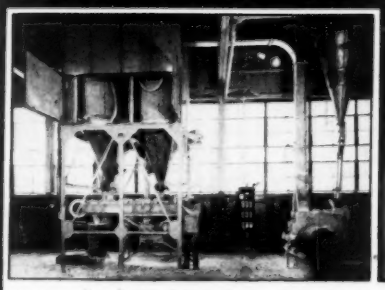

Installation of 4-Bag MIKRO-COLLECTOR (left) as auxiliary to No. 8 MIKRO-ATOMIZER (right). Atomizer grinds 2000 lbs. of a plastic material per hour to an average fineness of 5 microns. Collector handles 3600 c.f.m.*

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In the case involving these clauses, the contract was entered into on November 29, 1948 to become effective January 1, 1949 for one year. On December 3, 1948 the contracting union won a union authorization election. The petition by the rival union was filed December 7, 1948. *Broadway Iron & Pipe Corp.*, NLRB.

The following types of clauses have been held to be valid:

1. A contract provision for check-off on voluntary assignments is not invalid because of failure to provide that assignment was for one year or term of years which occurred sooner, since the authorizations themselves complied with statute. *Decker Clothers*, NLRB.

2. Provision in an existing contract that the employer will cooperate in urging employees to become members of a union and to retain membership and pay their union dues does not require a union shop election. A contract with such provision can bar an election upon petition of a rival union. *Ingalls Shipbuilding Co.*, NLRB.

CONTRACTS AS BAR TO AN ELECTION

1. Where contractual language is clear, evidence of practices and interpretation by parties is not controlling. *M. J. B. Co.*, NLRB.

2. Contract with union shop clause is no bar to an election, where no union shop election had been held *Clayton & Lambert Co.*, NLRB.

3. Three-year contract which has two years to run bars an election. *Hearst Publishing Co.*, NLRB.

4. Contract was held bar to an election where the petition was filed nine months prior to the termination and had four months to run at the time of the hearing. *Decker Clothers*, NLRB.

5. Failure to give notice of modifications under 8(d) of Act upon termination of the contract does not effectuate renewal of the contract. *Continental Southern Corp.*, NLRB.

ELECTION—OBJECTIONS

An employer's objection to an election that at the time of the election the number of eligible voters constituted less than one-third of the payroll when the plant was in normal operation, was overruled on ground that change in employer's method of selling its product reduced the complement of employees and there was no way of telling when employer would go back to the former method of selling so that employment roll would increase to what it formerly was. *John Mailin Peanut Co.*, NLRB.

Union can electioneer at a polling place at any time prior to balloting. Union official standing twenty-five to thirty feet from the ballot box,

Until they get their own wheels they ride on BASSICK GROOVED-WHEEL CASTERS

Marmon-Herrington's 12-station preliminary assembly line. Underframes are assembled at stations 1 and 2, on fixed alignment blocks. Dollies with Bassick Grooved-Wheel Casters on angle iron track carry the coach-units from station 3 to station 12 (foreground) and from there through the paint booth at left to the final assembly line.

Drilling full-length sills for coach underframes is done in a jig on a special carriage, moving along floor track. Carriage consists of two units, each supported by four Bassick Grooved-Wheel Casters.

Dollies feed complete front and rear Timken axle assemblies to coach-units at assembly station. Ramps in foreground show how easily the dollies, on their Grooved-Wheel Bassick Casters, are guided from floor to angle iron track.

In its manufacture of trolley coaches, Marmon-Herrington relies on Bassick Grooved-Wheel Casters running on angle iron floor track for important economies in assembly operations.

With a three-fold job of moving units along the preliminary line, feeding sub-assemblies at progressive work stations, and switching units from progressive to final assembly lines, Marmon-Herrington's Bassick installation is a striking example of the flexibility that is saving time, space and money in industries of every type, all over the country.

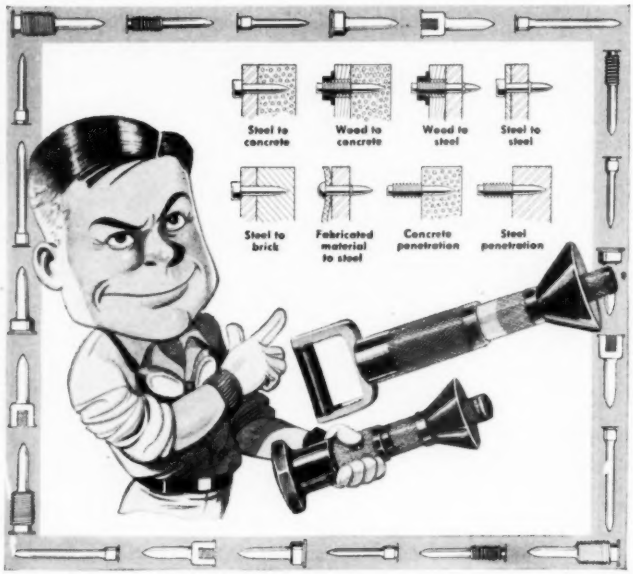
A Bassick Grooved-Wheel Caster System costs surprisingly little to install, maintain or re-locate. Why not find out just how this simple, flexible, economical method can benefit your own materials-handling or assembly operations? Write to THE BASSICK COMPANY, Bridgeport 2, Conn. DIVISION OF STEWART-WARNER CORPORATION. *In Canada:* BASSICK DIVISION, Stewart-Warner-Alemite Corporation, Ltd., Belleville, Ontario.

The industries that prize The Bassick Grooved-Wheel System Would open up your eyes — If I had space to list 'em!

Sold by Leading Industrial Distributors

Bassick

Making more kinds of Casters... Making Casters do more



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For fastenings in steel, concrete and other hard-to-work materials, RAMSET pays big dividends in time and money. Use the coupon for complete information.

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Please send details and arrange for demonstration of RAMSET FASTENING SYSTEM.

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Company _____

Address _____

LABOR DEVELOPMENTS *(continued)*

in sight of employees during voting, is not electioneering. This is no basis for objection to an election, especially since the employer failed to object at the time it took place. *Mutual Distributing Co.*, NLRB.

ELECTION—ELIGIBILITY TO VOTE

Seasonal industry—Election is held at or near the seasonal employment peak. If there is more than one seasonal employment peak, the election is held near one of them. These rules are applied to multi-employer unit and to union shop elections. The principle is that employees eligible to vote should be as far as practicable most nearly representative of the total employment in the unit; but this does not mean that every employee conceivably affected by the election must be eligible so long as those who are eligible are representative of the entire unit. This rule is based on administrative practicality. Thus, in a multi-employer unit union shop election, the fact that the number of persons eligible to vote among the employees of one employer was not representative of that employer's total employment roll does not constitute a valid objection to the election. *Tree Fruit Labor Relations Committee*, NLRB.

ELECTION—INTERVENTION

After the close of a hearing, a union seeking to intervene and get on ballot may show an adequate representative interest in the employees as of the date of the hearing. Thus, where a union waived any interest in a consent election which was later set aside by the Regional Director, it cannot intervene at a hearing on the petition held two years after the original election without a showing of such interest as of the date of the original consent-election agreement, the two-year delay having been occasioned by reason of the employer's unfair labor practices and through no fault of the petitioning union. *Lufkin Foundry & Machine Co.*, NLRB.

NON-COMMUNIST AFFIDAVITS

Compliance with the requirement of filing of non-communist affidavits is no subject matter of litigation before the Labor Board in a complaint case or a representation case. *Shawnee Milling Co.*, NLRB.

"FRONTING" NOT ESTABLISHED

—By proof that the petitioner was aided by a noncomplying union in an organization or that petitioning union paid noncomplying union for such assistance, where the petitioning union was a bona fide and long-established international union and there was no reasonable basis for believing that employees are in

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United States Steel Supply Company
has added aluminum to its line of products
Warehouses of the United States Steel Supply Company are now arranging to carry in stock a complete line of aluminum mill and building products manufactured by the Reynolds Metals Company.
This is further indication of the far-reaching expansion program of United States Steel Supply Company and its desire to satisfy more completely the metal requirements of its customers.
Initially, aluminum mill products — such as structurals, bars and sheets are stocked at the firm's Los Angeles, San Francisco, and Chicago warehouses.
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As a *good* secretary you know it isn't the regular assignments that make a hit with the boss, but rather the little thoughtful things.

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General Boxes reduce costs; furthermore, they provide protection. Hundreds of firms know this, but perhaps your firm doesn't.

Why not drop your boss a memo? He'll be glad you did . . . and it will be added proof that you ARE a good secretary.

memo
Note that General Box Company is cutting packing and shipping costs for many firms—Seems like we should check on this—huh?
Mary

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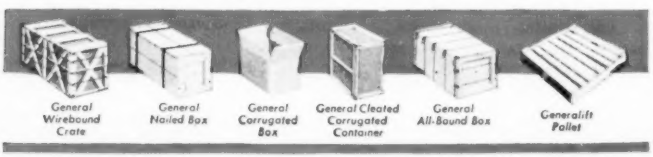


LABOR DEVELOPMENTS *(continued)*

doubt as to which union will represent them. *Morrison Turning Co.*, NLRB.

—By proof that a year before the union's petition was filed an officer of a noncomplying union suggested to his union that a complying union of the same international organize the employees, petition for an election, and turn the resulting contract over to the noncomplying union, since there was no evidence that the petitioning union, a legitimate international, was party to this scheme. *Stokely Foods, Inc.*, NLRB.

CERTIFICATION—MINORITY UNION RIGHTS

Despite certification of a bargaining agent, individual employees or group of employees have the right to be represented by another union in adjustment grievances, and their strike to compel employer to adjust grievance with such minority union does not constitute an attempt to compel dishonor of the certification in violation of Section 8(b) (4) (c) of Act. *Douds v. Local 1250, Retail, etc.*, NLRB.

UNION UNFAIR LABOR PRACTICE

Inducing employees to strike to compel negotiations with the union in disregard of the current certification of another union was held to be a violation of Section 8(b) (4) (c). *Oppenheim Collins*, NLRB.

MINORITY PICKETING—INJUNCTION GRANTED

Injunction against mass picketing which blocked employer's customers, nonstriking employees, and officials from entering plant granted. The number of pickets was fixed by the Court. *Rice & Holman v. Electrical Workers*, NLRB.

MINORITY PICKETING—INJUNCTION GRANTED

Where a minority group, dissatisfied with the contract between an employer and a union, picketed the employer with signs that the employer was unfair, the Court held that the signs were held to be untruthful, picketing should be enjoined, and there was no labor dispute. *Sanitary Automatic Candy Corp. v. Lederfine*, NLRB.

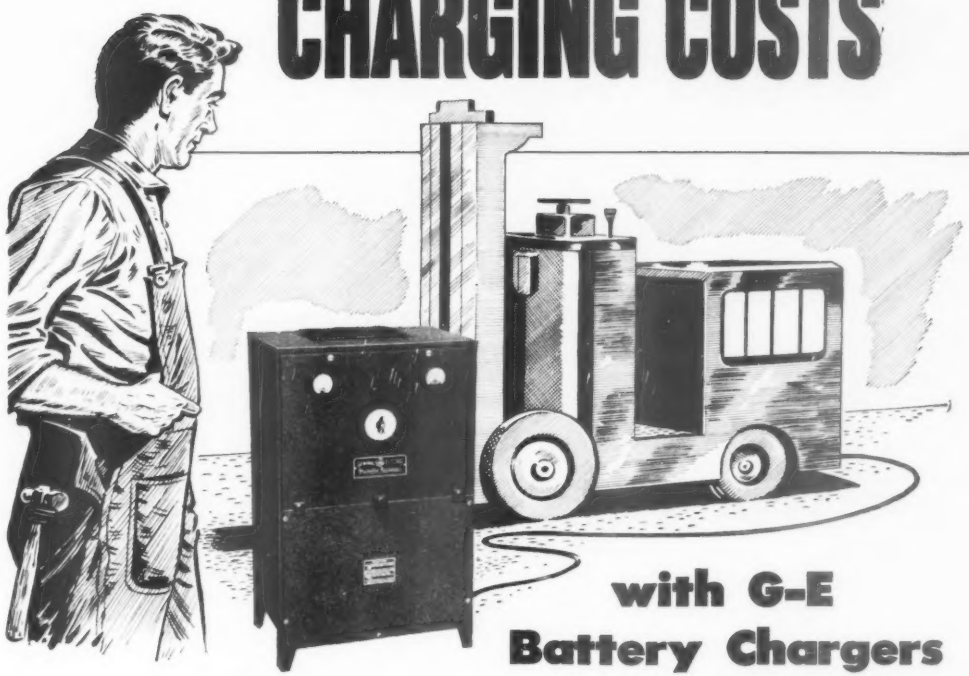
MONOPOLY CONTRACT PROVISION—INJUNCTION GRANTED

Provision of a labor contract restricting the sale of certain products by employer-retailer to hours when the union members were employed, violates the state monopoly law, and enforcement of the provision is enjoinable. *Kald Kist, Inc. v. Meat Cutters Union*, NLRB.

CERTIFICATION—STATUS AFTER FIRST YEAR

"The presumption of a majority, conclusive, during the year following the certification, 'continues until cir-

GET LOW ELECTRIC-TRUCK CHARGING COSTS



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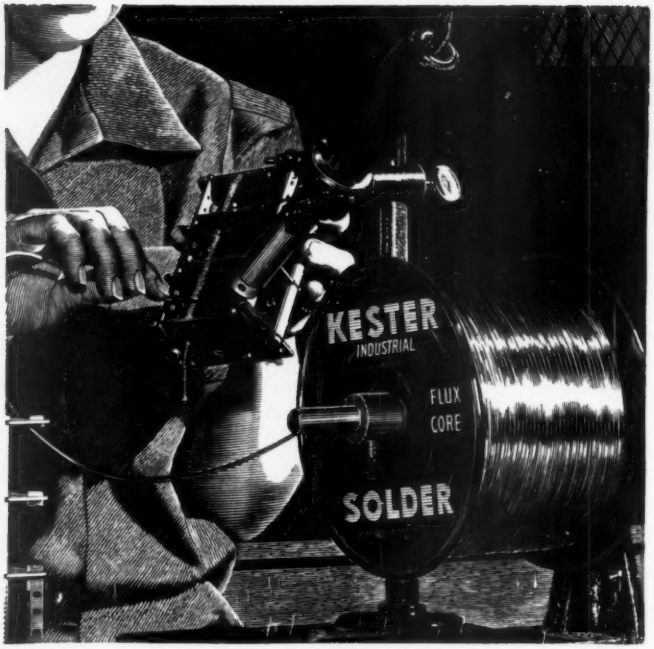
GENERAL ELECTRIC

466-202



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cumstances arise which indicate that it no longer holds true.' Matter of Bethlehem Steel Company, 73 NLRB 277; Matter of Dorsey Trailers, Inc., 80 NLRB 478." *Superior Engraving Co.*, NLRB.

"FRONTING" FOR NONCOMPLYING UNION

Proof of "fronting" is admissible. Proof sufficient to establish "fronting" if not rebutted: "voluntary" organizer, not plant employee, helped employees form group; officials of noncomplying union consulted with these employees and no other union was consulted; attorney came from out of town to advise the new group, although it has no funds. *R. J. Reynolds Co.*, NLRB.

ENFORCEMENT

After entry of a Court decree enforcing a Board order, the Board has the right, without application, to hold hearing and make finding to implement the general remedial provisions embodied in its earlier order since the decree is of interlocutory character. Thus, the Board may proceed to hold a hearing and make specific findings concerning amount of back pay, the existence of former job or its equivalent. However, Board does not have authority to go into whether there has been compliance with enforcement, since there has been an offer of reinstatement, sufficiency of reinstatement, and the adequacy of the posting of the notices; particularly since in the last-mentioned instance the original decree is specific rather than general. (NLRB v. Bird Machine Co., CCA-1)

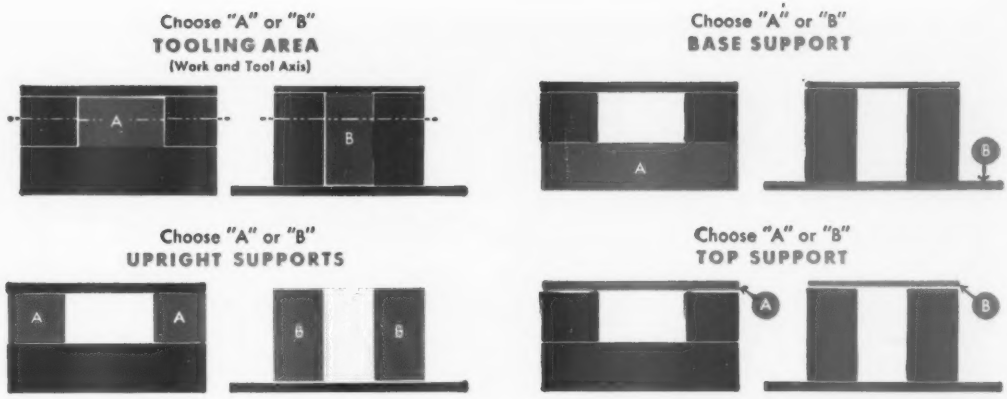
Wage Hour

COVERAGE

Maintenance employees of an office building are not covered by FLSA, regardless of what percentage of the tenants are engaged in interstate commerce within the meaning of the Act, since running an office building is regarded as a local enterprise. The Court relies on 10 East 40th St. v. Callus, 325 U.S. 578. (Hunters v. Madison Ave. Corp., CCA-6)

BONUSES

Bonus under Employee Participation Plan computed on total earnings, including overtime, results in no statutory overtime remaining due. But when the plan was made retroactive, statutory overtime is due for the retroactive period, even though the bonus was computed on the basis of total earnings for these years, because such bonus is not an incentive like a bonus for current earnings and does not depend on the number of hours worked. (Sroinkin v. Fairchild Camera Corp., CCA-2)



HOW GOOD ARE YOU ON MACHINE DESIGN?

The all-round efficient service given by any machine tool, and the opportunity for its improvement and development, usually depend on advantages afforded by its basic design. Before purchasing a machine it will pay to look for the advantages or disadvantages of its basic design.

	MACHINE #1*	MACHINE #2	MACHINE #3	MACHINE #4	MACHINE #5
WORK & TOOL CAPACITY	✓				
WORK & TOOL SUPPORT	✓				
WORK & TOOL MAINTENANCE	✓				

*CONOMATIC

Any good investment has certain qualifications that prove it profitable. The wise investor and smart banker have some sort of measuring stick to analyze every investment they make.

Why not use a measuring stick to chart your purchases of Automatic Bar Machines? If you are already using a chart, perhaps you would like to compare it with the one that we have prepared. Write to us for a copy or ask the Cone representative.

Above are illustrated two types of frame design of Multiple Spindle Automatic Bar Machines. Assuming that the Tooling Area is important — and is as efficient as the frame around it permits — which of the two designs would you choose to meet the following requirements?

WORK & TOOL CAPACITY

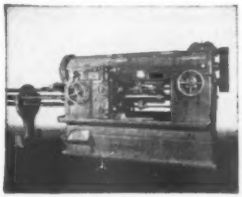
Long, open, roomy Tooling Area and long main end slide for handling longer work and for clearing die heads in threading, etc., to the full collet capacity of the machine; for heavy cross-slide cuts, deep hole drilling, and general all-round work with HSS or Carbide Tools.

WORK & TOOL SUPPORT

Genuine, horizontal, rectangular box-frame, free of overhang; heavy-set, rigid upright members for supporting head-stock and gear box units between heavy, full-length top and base members, for substantial support of all work and tools close to the work and tool axis, and for the maintenance of accurate alignment of work and tools.

WORK & TOOL MAINTENANCE

Heavy, strong, well supported, overhang-free, vibration-free, liberal bearing, convenient, adjustable, work holding units and tool slides, with accessible chip-free cams, with adequate capacity in base member for chip disposal and cutting coolant.



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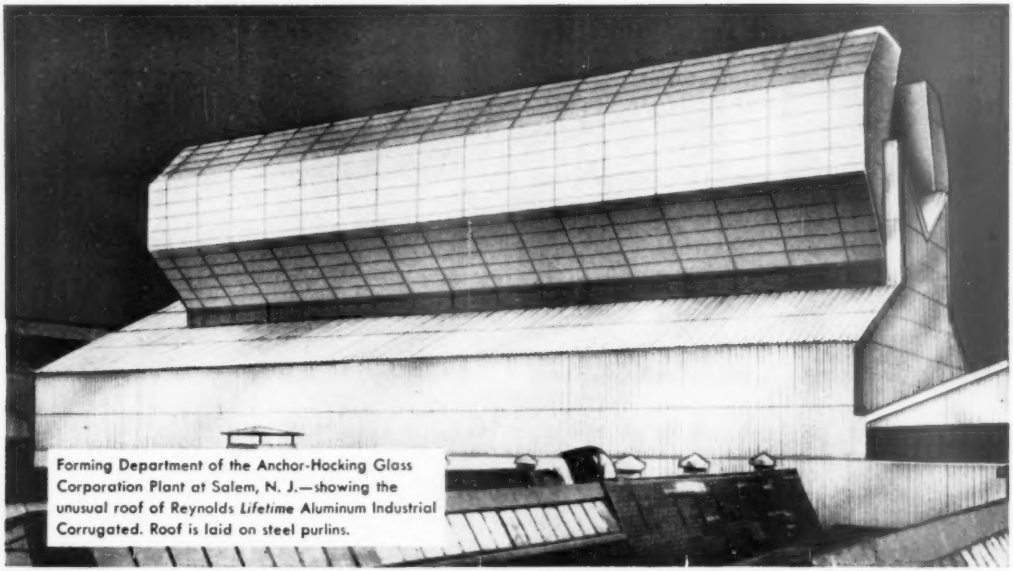

Forming Department of the Anchor-Hocking Glass Corporation Plant at Salem, N. J.—showing the unusual roof of Reynolds *Lifetime* Aluminum Industrial Corrugated. Roof is laid on steel purlins.

Anchor Hocking uses Reynolds *Lifetime* Aluminum Industrial Corrugated on Salem, N. J. Building

"A great name in glass" turns to aluminum . . . for roofing. This Industrial Corrugated is .032" thick, with extra deep corrugations for added strength. Rustproof and corrosion-resistant, it needs no protective painting . . . lasts indefinitely without maintenance. Lighter structural load affords framing economies. Radiant heat reflectivity takes off the summer sun load, makes winter heating more economical. Where under side is exposed, the bright aluminum improves illumination.

Application is simple, over any type of purlin. Reynolds supplies all necessary accessories for complete installations. If you have a special construction or building repair problem, call on our engineers. **Reynolds Metals Company**, Building Products Division, Louisville 1, Ky. Offices in 32 principal cities.

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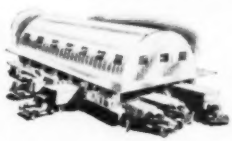

All-aluminum, Patented all-bolt construction. Basic unit 36' x 60', length variable by 6' sections. Wide choice of door and window arrangements.

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(THE HAMILTON PORTABLE ELEVATING TABLE)

Portelvator increases production by accomplishing the muscle jobs easily. Eliminates ganging up on heavy lifts. Reduces strains and bruises to office frequency. Buy this brawny helper for each machine, and then . . . "Send one man, and Portelvator".

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- Raises — lowers — transports.
- Levels and supports overhanging work.
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Get the story of the new time and money saving General Electric exchange plan for Tri-Clad integral-hp motors! It's an extension of the highly successful G-E fractional-hp motor exchange plan and covers most popular types of Tri-Clad open dripproof motors—one to five hp. Bulletin GEA-5189 is for motor users; Bulletin GEA-5180 is for machinery manufacturers. Write on your letterhead FOR FREE COPY: *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Look for this extra on the motors you buy; it means lower maintenance costs, less time lost for motor replacement.

GENERAL ELECTRIC

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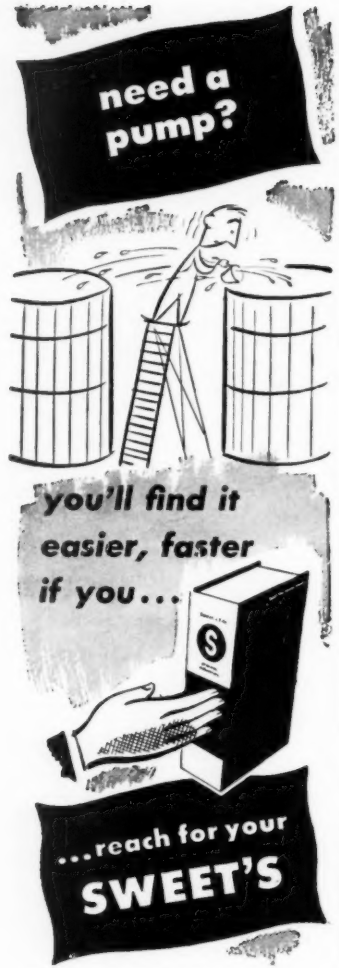

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LOUIS RUTHENBURG, President, Servel, Inc., speaking before Pittsburgh Chamber of Commerce

American inventive ability, untrammeled and operating under effective incentives, has developed a great wealth of new and desirable products and constantly improved techniques of production. Mechanical power has rapidly supplemented manpower. We have learned to work more effectively together as productive human groups. As the direct result of such developments we have achieved rapidly increased productive efficiency. An essential factor in the formula has been constantly increasing investment of funds in the facilities for production. Let's look at a 90-year record:

Year	Investment Per Plant	Investment Per Worker	Horsepower Per Worker	Annual Wages Per Worker
1849	$4,000	$500	Very little	$248
1879	10,000	1,000	1.3	346
1909	70,000	3,000	2.9	510
1939	270,000	6,000	6.4	1,150

That index of mechanical horsepower per worker has amazing significance which is not fully appreciated. You know, of course, that no other country in the world remotely approaches the United States in the application of mechanical power. Back in 1929, when we had only 4.86 hp. per worker, Germany had 2.6, Great Britain 2.56, Canada 2.17, Italy 2.14, and France only 1.78.

In this country the power applied per worker has now increased to 7.25 hp.—which, by the way, is equivalent to the muscle power of 58 men because a man develops only one-eighth of a horsepower.

The average worker in the United States, therefore, has placed at his disposal an amount of power which is equivalent to the muscle power of 58 men.

That great advantage—that tremendous leverage which raises our relative living standard—is a direct reflection of investment. In the 90 years between 1849 and 1939 the investment per worker in the United States increased 12 times.

Plant Maintenance Show and Conference in January

The first Plant Maintenance Show, an exposition devoted exclusively to cost reduction through improved installation, operation, and maintenance of equipment and services in factories, warehouses, and other plants, will be held in the Auditorium, Cleveland, Ohio, January 16-19, inclusive. Concurrently with the show, a four-day conference on plant maintenance methods will be held, with L. C. Morrow, editor of FACTORY, as general chairman.

Exhibits and conference subjects will cover air conditioning, heating and ventilating; buildings, building materials, and services; electrical equipment; employee relations, training, and safety; instruments and meters; lubricants and lubricating equipment; maintenance tools and supplies; management consultation services; materials handling methods and equipment; mechanical rubber goods, including belts, hose, and packing; paints, painting equipment, and product finishes; power generation and distribution; power transmission, welding, and gas cutting.

The show and conference will emphasize those aspects of plant operation not concerned with direct production but whose share in total costs is a considerable factor.

There will be no charge for either exhibit or conference attendance. Advance registration cards may be obtained from Clapp & Poliak, Inc., 350 Fifth Ave., New York 1, N. Y.

New Scientific Management Award

An annual award was recently established "for distinguished contribution to scientific management in the international field."

This award, called the Wallace Clark International Award, is in honor of the late Wallace Clark, international management consultant.

It was established by the ASME, AMA, SAM, and ACME, and is given through the National Management Council.

First recipient of the award was Dr. Hugo de Haan of Geneva, Switzerland, general secretary of the International Committee on Scientific Management.

Benefits Increase Wage Costs 15 Per Cent

The typical American worker in 1947 received benefits from his employer of more than $424 above his wages, reports the United States Chamber of Commerce. This means, asserted the Chamber, that the hourly wage rate no longer is the total labor cost in business.

Basis for the statements is a report

SQUARE D's *New*

SAFETY SWITCHES

*Types A, C and D

Backed by 40 years' DESIGN LEADERSHIP

The remarkable superiority of this new switch line is reflected in these TYPE A design and operating features:

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SILVER-PLATED current-carrying parts.

EXPOSED BLADES permit visual checks of switch operation.

DEAD-FRONT line terminals are protected by hinged arc chamber cover.

MAGNETIC ARC PLATE adds to unusually high rupturing capacity.

POSITIVE PRESSURE jaws and fuse clips, steel reinforced, silver-plated.

NON-TRACKING insulation used in base. Melamine insulating cross-bar.

REMOVABLE PRESSURE CONNECTORS permit substitution of solder lugs, where preferred.

**Types C and D* *similar to Type A in appearance—differ in construction details*

In production: 30 and 60 ampere sizes ... **NOW** · 100 and 200 ampere sizes ... **SOON** · Larger ampere sizes ... **LATER**

***Write* for Bulletin 3100 • Square D Company, 6060 Rivard Street, Detroit 11, Michigan**

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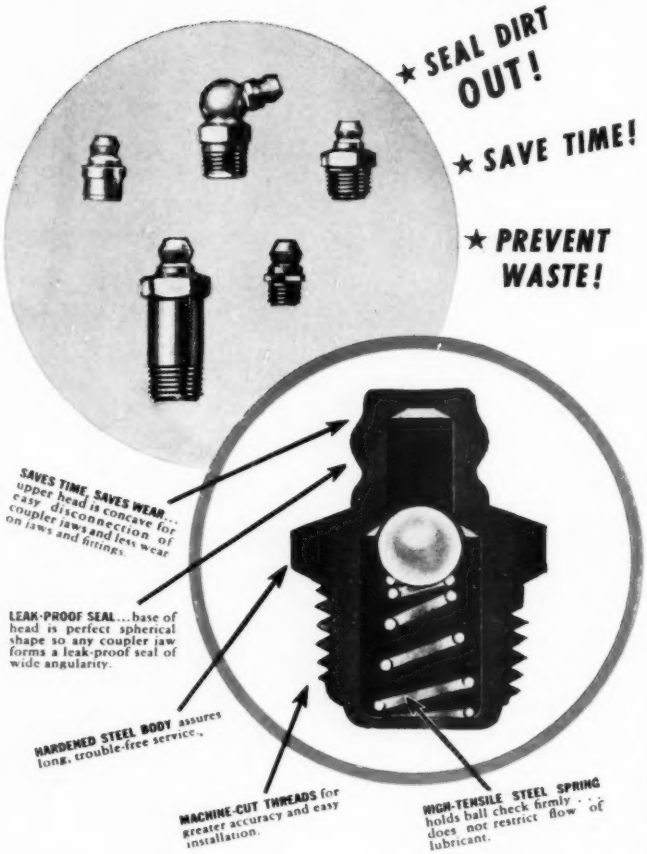
ARO Grease Fittings FOR EVERY NEED


★ SEAL DIRT OUT!
★ SAVE TIME!
★ PREVENT WASTE!
SAVES TIME, SAVES WEAR... upper head is concave for easy disconnection of coupler jaws and less wear on jaws and fittings.
LEAK-PROOF SEAL... base of head is perfect spherical shape so any coupler jaw forms a leak-proof seal of wide angularity.
HARDENED STEEL BODY assures long, trouble-free service.
MACHINE-CUT THREADS for greater accuracy and easy installation.
HIGH-TENSILE STEEL SPRING holds ball check firmly . . . does not restrict flow of lubricant.

Specify ARO Grease Fittings for every lubrication point . . . they're precision-made . . . accurate . . . rugged . . . dependable. Can be serviced by all leading brands of hydraulic couplers. Complete range of types and sizes . . . Aro-built Quality. Write for Catalog 102. The Aro Equipment Corporation, Bryan, Ohio.

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ALSO... LUBE EQUIPMENT... AIR TOOLS
HYDRAULIC EQUIPMENT
AIRCRAFT PRODUCTS

recently completed by the Chamber's Economic Research Department. It stated that the typical company had a "hidden payroll" of costs other than wages amounting to more than 15 per cent above the company's wage bill. Non-wage costs as defined in the report included pension insurance, life insurance, old-age and survivors' insurance, workman's compensation, non-production bonuses, profit-sharing, and other benefits.

The report showed that smaller companies had smaller proportionate non-wage payments. Firms employing 1000 and more reported that payments leveled off around 15 per cent.

The trend is one of increasing non-wage costs, stated the Chamber. Union demands emphasize "so-called fringe and similar benefits as supplements to wage income."

$8389 Average Invested for Each Plant Worker

Reprinted from THE CLARKSON LETTER, Clarkson College of Technology, Potsdam, N. Y.

The public should be made familiar with the fact that the average investment for plant and equipment necessary to put a man or woman to work in an American manufacturing plant is $8389. The range is from $3759 per wage earner in textiles to $21,205 in the telephone system, and $27,375 in chemicals. It costs several thousand dollars more in capital funds for inventory and working capital to keep them at work.

Struggle Over the Status Quo

Reprinted from FRANK RISING'S "Memo to Management"

One of the most obvious differences between management and unions, demonstrated at this time in several strikes, is found in the fear of unions that they will "work themselves out of a job" and the desire of managers to get any job done and get on to another one. One side dislikes change, and fears it; the other believes in change, particularly the change which allows work to be done better, faster, more easily.

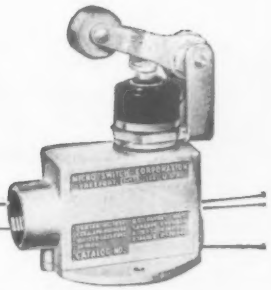
When the hard facts of competitive economics finally replace the unrealities of a sellers' market, after some years of getting used to a sort of "easy come, easy go" life, people find it difficult to alter habits. The status quo becomes so important to some that any alteration is labeled a speed-up.

To call all change a speed-up is too glib. We should ask ourselves, "Speed-up from what?" Our operations during wartime and post-war boom, our habits, our day-to-day method of doing things suffered serious deterioration in many ways. Correction of sloppy operations is a competitive necessity.

The cries of "speed-up" are loudest

Modernizing for economy?

Consider this MICRO suggestion



for rehabilitating present equipment!

Many an older machine springs back to new life . . . giving increased production and savings in operating costs by the installation of MICRO precision switches to make it automatic, to limit operation, to provide electrical interlocks or safety features.

The new up-to-date features so noticeable on new equipment that make management question the ability of the old are often yours by applying a bit of ingenuity—and one or more MICRO precision switches.

When modernizing your equipment, economy suggests that you have your plant men investigate how MICRO precision switches can put new life and new productivity into the equipment you already have!

For experienced aid in the use of MICRO precision switches, write MICRO SWITCH, Freeport, Illinois. Branch offices: Chicago, New York, Boston, Cleveland, Los Angeles. Sales Representatives: Portland, St. Louis, Dallas, Toronto.

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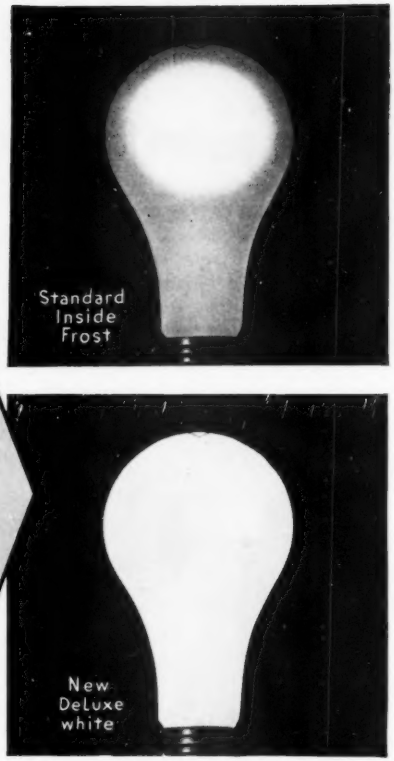
Used to make equipment
AUTOMATIC...for LIMIT CONTROL...for SAFETY
...for ELECTRICAL INTERLOCKS

BE THE FIRST

to give your workers the benefit of this NEW AND BETTER BULB

the CHAMPION DE LUXE WHITE LAMP!



The instant you compare this new CHAMPION Lamp with the ordinary 100 watt bulb you'll want to adopt the *De Luxe White* as your standard. It's the greatest improvement in lamp bulbs since the inside frosted bulb first came out twenty-five years ago.

The CHAMPION *De Luxe White* gives a soft, white light, highly diffused, easy on the eyes, at *no sacrifice in light output*. Reflected glare from shiny surfaces is cut way down. It's the same size, has the same electrical and illumination characteristics as the standard 100 watt inside frosted lamp. It's ideal wherever bulbs must be exposed or unshielded. It means less glare — better, pleasanter seeing.

ASK YOUR INDUSTRIAL OR ELECTRICAL SUPPLIER TO DEMONSTRATE THE NEW CHAMPION DE LUXE WHITE LAMP

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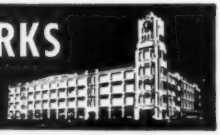
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



in departments where the greatest loosening, the largest percentage of inefficiency lie. This is the finding of managers generally these days; the trouble is not where the employees are doing a job well, it is where the slack and lazy habits are most pronounced. If the good and honest workers could see this clearly, if they could understand it, we might not have so much trouble with the recalcitrant, rebellious, resentful minorities.

Part of the Answer

You hear one question more than any other, in management gossip sessions: "How long will this last . . . how much more of it . . . are we in for a good deal of such trouble?" And part of the answer can be found in the analysis above; yes, we are in for a good deal of it.

It is not going to be easy to correct bad habits, it is going to take time to convince people that management finally has to quit compromising, appeasing, "going along" with increases in costs either through paying more for the same work or the same for less work. It just can't be passed along, as the saying goes.

To put it another way, economic compulsion has come upon us. That makes a tremendous difference. Few of us face this unpleasant, arduous, brain-racking study and improvement unless we finally are compelled to, but now we must.

Now, management really *is* firm—because it has to be done. The union can't win rights to control work standards unless the companies are to be run out of business. Consequently, I don't believe that any hope of the union to freeze loose standards will succeed—no matter how many months are spent in threats, slow-downs, and strikes.

Contract Clause Guards Against Employer Abuse

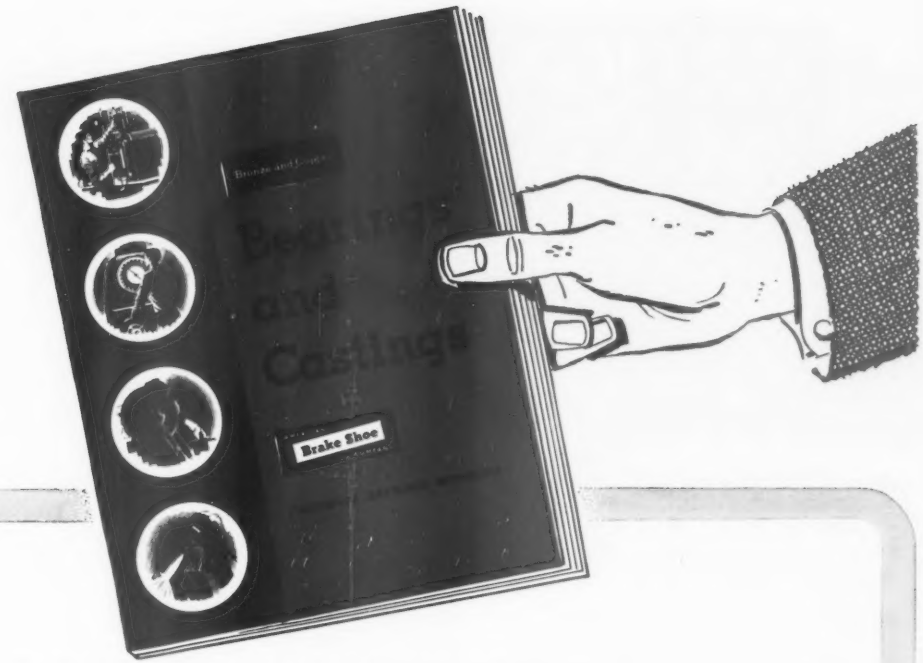
The American Blower Company, Detroit, has a union contract clause protecting the company against unwarranted abuse in the union paper.

Moreover, the union, Local 254 of the UAW-CIO, has agreed the company should have the right to file a formal grievance if it feels articles in the union paper interfere with cordial labor management relations. The contract clause was reported by the National Foremen's Institute.

Grant to Aid Study of Business Records

A grant of $35,000 has been given to the National Records Management Council by the Rockefeller Foundation for a study of problems in the preservation of business records.

Under the grant, to be administered by New York University, the



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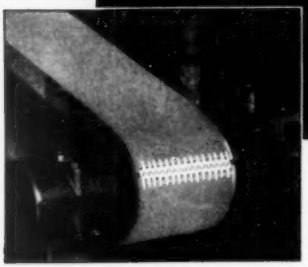

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council will promote records of management programs in business and will assist in establishing company archives.

BEHIND THE BYLINE

Facts About Factory's Authors

Allan H. Mogensen's name (page 66) is closely linked with work simplification. After graduating from Cornell University, he taught industrial engineering and management at the University of Rochester, at the same time serving as consultant for several Rochester firms. In 1930 he joined the staff of FACTORY, where he pioneered articles on motion economy and work simplification. In 1937 he started the Work Simplification Conference, now held each year at Lake Placid Club, and in the same year received the Gilbreth medal for outstanding achievement in the field of management. He is author of *Common Sense Applied to Motion and Time Study*, and many articles and pamphlets on special management problems.

Charles Winkelman (page 70) joined the staff of Belden Manufacturing Company in 1922 as an inspector in the rubber department of their Chicago plant. He was for a period time study engineer and supervisor, and in 1935 was appointed to his present position, chief industrial engineer of the Richmond, Indiana, plant. Since 1941 he has been teaching, both in private industry and for Purdue University. His hobby is photography.

Philip J. Gifford (page 121) served as machinist apprentice in railroad shops and at National Tube Company before starting work for Thew in 1929 as a machine operator. In

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THE POPULAR No. 214 . . . ONLY 8½ LBS.
Zips through 14 gauge hot rolled steel at speeds up to 20 ft. a minute. Needs only guiding. Follows straight lines, curves, angles, notches right to the line. Blades easily removable for sharpening.
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Cuts up to 18 gauge hot rolled mild steel, fast as you feed it, up to 15 ft. a minute. Easier and faster than hand snips. Blade action feeds in the work: operator just guides the Unishear. Hairline accuracy on curves, straight lines, angles, notches . . . inside or out. Duplex handle for convenience in any position.

Take sheet metal work out of the "tin snip stage", put it on a real production basis with a Stanley UNISHEAR. Free skilled labor for more profitable work. Cuts iron, copper, aluminum, zinc, tin, leather, fibre, wire, linoleum . . . almost anything in sheet form. Does hundreds of production and maintenance jobs around the plant . . . cutting metal and fibre patterns, cutting metal linings, making machine guards, covers, tanks, drip pans, repairing ventilating systems, fabricating spray booths, partitions, shelving, trays, parts boxes and bins. Save time, material and labor. See these hard-working lightweight metal workers at your industrial distributor's and write today for detailed literature. Stanley Electric Tools, 506 Myrtle St., New Britain, Conn.

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Your Sonneborn Man can help you. Here are some of the ways he might do it.

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Or, if the situation called for it, he might attack the problem from inside, with still another Hydrocide. This is a mastic, that stops water and acts as a base for plaster or concrete. You apply it inside, of course.

Then again, you may need help with below-grade water-proofing. Here, he may recommend a single troweled coat of another Hydrocide. It's as efficient as expensive conventional systems that call for as many as *five* layers of material.

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BEHIND THE BYLINE *(continued)*

1937 he became machine shop foreman, and in 1947 was promoted to the position of plant supervisor. A year later he was appointed to his present post of maintenance superintendent. Photography and radio are his hobbies.

F. R. Elliot (page 137 is a graduate of Northeastern University, Boston. He started to work for Westinghouse Electric Corporation in 1924. He served as chemist and metallurgist at the Cleveland Works, materials engineer at East Pittsburgh, then became superintendent of the Foundry and Feeder Division at East Springfield. He returned to East Pittsburgh as manufacturing engineer at Trafford Foundry, and is now back in East Springfield as foundry superintendent.

Walter P. Kronquist (page 116), a native of Peoria, joined Keystone 33 years ago as a machinist, following completion of a four-year apprenticeship with a local railroad. After serving in the Navy's submarine service during the First World War, he returned to Keystone. He became foreman, and in 1928, steel mill mechanical superintendent. Mr. Kronquist belongs to no industry or professional organizations. He is an active sportsman, devoted father, husband, and Peorian.

Born in Zitacuaro, Mexico, Donald A. Campbell (page 132), manager of the Bryant Industrial Division of the Affiliated Gas Equipment, Inc., was graduated from the university of Colorado with a B.S. in electrical engineering. Previously associated with H. L. Doherty & Company in various engineering and sales capacities, he joined the Bryant Heater organization in 1944, and specializes in industrial gas combustion equipment. He is a member of the Cleveland chapter of the ASME, the American Gas Association, and the Midwest Industrial Gas Sales Council.

But what about the DISAPPEARING ACT *in your plant?*

You might be even more mystified to discover just how much of the electric power you pay for isn't there when it gets to the machines. It's the black magic of overloaded, over-extended, obsolete wiring* that slows down motors and men.

Your plant power engineer, consulting engineer, electrical contractor or utility power salesman knows how to materialize your vanished power. Better ask . . . *soon.*

***WIRE AHEAD** . . . a comprehensive discussion of preventive maintenance, points out the symptoms of inadequate wiring, presents detailed plans for anticipating electrical demand. Forty-eight factual pages of practical information and suggestions free on request.

Densheath Type TW Building Wire with its special thermoplastic insulation is sound production insurance in any plant. It will not support combustion, is long-aging, impervious to acids, oils and alkalis. It is recognized by the National Electrical Code for circuits up to 600 volts and temperatures up to 140° F. . . . and for wet and oily locations. Being light weight, with a smooth, slick finish and without braid, Densheath pulls through easier . . . resists abrasion. Permanent, bright colors for quick circuit identification. Write for literature.

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De Laval double reduction speed reducers, consisting of combinations of double worm gear reductions, or helical and worm gear reductions, are available with overall ratios up to approximately 8000 to 1. De Laval single reduction worm gear speed reducers are available in ratios up to 90 to 1. If high ratios are your requirement, worm gear speed reducers are the answer—particularly if space is limited and reliability is important. A De Laval representative will help you pick the right size and type.

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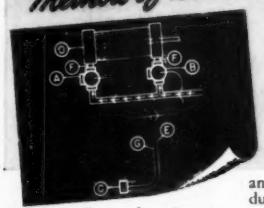
How to Boost Production with new Method of Mounting Ross Valves



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Operation is by a small, conveniently located 3-way pilot valve (C). It is supplied through tubing (E) and connected to the master valves by tubing (G). It may be mechanically, manually or electrically controlled. Hand or foot operation is greatly facilitated by the use of the smaller, more easily actuated pilot model.

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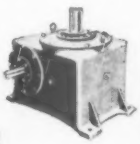

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Hypower Drives bring new compactness in design, lower original cost, lower operating cost, through increased thermal capacity.

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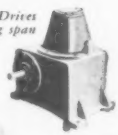

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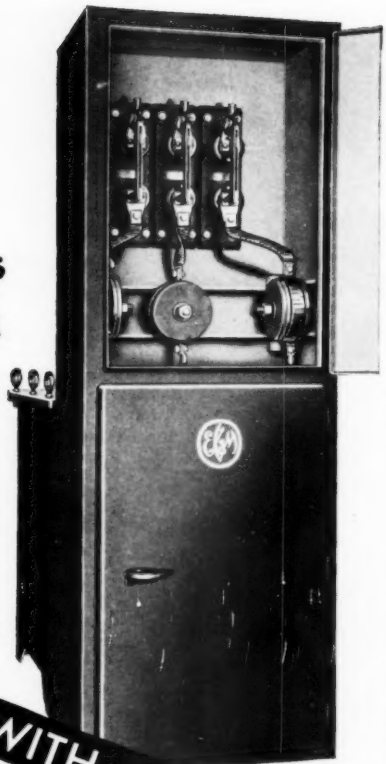
- ☐ Straight Line Enclosed Gear Drives



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BOOKS

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EDNA YOST. Rutgers University Press, New Brunswick, N. J. 360 pages. Photographs. $5.

Since the introduction and meteoric popularity of "Cheaper by the Dozen," many people have expressed a desire to know more about this dynamic couple who have contributed so much to the field of management. This new book, long in preparation by a writer who has collaborated before with Dr. Lillian Gilbreth, fills this long-felt need. Many know Frank Gilbreth as the father of motion study; few realize that before going into this field he was one of the country's foremost building contractors. The story of how Frank, engineer, became one of the world's greatest management engineers is a story of the great love and hope and confidence of the "First Lady of Engineering." One can only wish that the story of the lives of these two grand people could have been illustrated with more photographs, of which there must have been thousands from which to choose.

Management Planning and Control

BILLY E. GOETZ. Prof. of Bus. Admin., Antioch College. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 294 pp. Tables, specimen forms, graphs, charts, bibliography, name and subject indexes. $3.75.

Subtitled "A Managerial Approach to Industrial Accounting." A discussion of both the theory and practice of accounting in terms of managerial needs for specific data for use in solving problems of planning and control.

Oxyacetylene Welding and Cutting

STEWART PLUMLEY, formerly chief engineer, Smith Welding Equipment Corp.; revised and rewritten by **T. B. JEFFERSON,** editor, "The Welding Engineer." Revised 4th edition. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 356 pp. Photographs, drawings, tables, specimen forms, diagrams, appendix, index. $6.50.

This is a "Course of Instruction" on all types of welding and cutting, including pipe-line welding, flame-cutting steel and cast iron, brazing, lead welding, bronze welding and brazing, hard-facing, boiler and firebox welding, and welding light metals. It explains basic principles, discusses step-by-step techniques, how to develop skill in both repair and production work. Job shop operation and management also are covered.

Welding Metallurgy—Iron and Steel

O. H. HENRY, professor of metallurgical engineering, and **G. E. CLAUSSEN,** formerly adjunct professor of metallurgy, Polytechnic Institute of Brooklyn. Revised by **G. E. LINNERT,** senior research engineer, Armco Steel Corp. American Welding Society, 33 W. 39th St., New York 18. Revised 2nd edition. 505 pp. Photographs, drawings, diagrams, tables, charts, appendixes I, II, III, index. $2.50.

Written for both technical and non-technical readers, the book presents fundamentals of metallurgy, procedure in the welding of specific materials, and effect of different elements. It includes information on stainless, heat-resisting,

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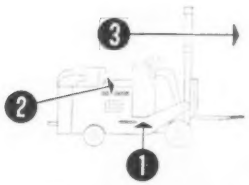

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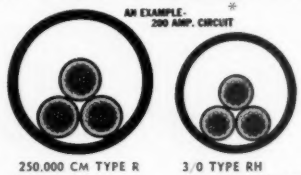

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The Economic Theory of Cost of Living Index Numbers

MELVILLE J. ULMER. Columbia Univ. Press, Morningside Heights, New York 27. 106 pp. Charts, tables, graphs, formulas, appendices A, B, C, bibliography, index. $2.

A study of existing index number theories, with emphasis on the development of a practical method for estimating changes in living costs which will have theoretical significance for both the economist and the business analyst.

English-Italian Technical Dictionary

GIORGIO MAROLLI, technical manager, Fiat Corp. Felice Le Monnier, Florence, Italy. 630 pp. List of abbreviations, tables, appendix. L.2700.

Selected engineering terms in both English and Italian presented in an effort to promote an exchange of technical and scientific knowledge.

Plant Production Control For Factory Operations

CHARLES A. KOEPKE, production management consultant. John Wiley & Sons, 440 4th Ave., New York 16. 2nd edition. 568 pp. Photographs, sketches, diagrams, charts, tables, forms, bibliography, index. $5.50.

Written primarily "to teach and demonstrate methods of controlling the flow of materials through any type of commercial enterprise." Suggests procedures for insuring proper control, and emphasizes the need for a balanced organization in which the several groups check and review each other's work in an effort to coordinate the program.

Psychology of Personnel in Business and Industry

ROGER M. BELLOWS, Ph.D., chairman and professor, department of personnel methods, School of Bus. Admin., Wayne Univ. Prentice-Hall, Inc., 70 Fifth Ave., New York 11. 499 pp. Tables, charts, selected references, sample forms, sketches, appendixes A, B, index. $6.

Intended for use in supervisory training and industrial management courses in business and industry, this volume is divided into four sections: Development of Personnel Technology; Tools for Effective Use of Personnel; Worker Satisfaction Through Human Understanding; and Implications of Personnel Technology.

BOOKLETS

PICTURE FACTS ABOUT THE WORK SIMPLIFICATION CONFERENCES. Allan H. Mogensen, 330 W. 42nd St., New York 18. 16 pp. Photographs. No charge.

WHAT'S AHEAD IN EMPLOYEE HEALTH AND PENSION PLANNING. Practical problems in personnel administration. Personnel Series No. 126. Papers presented at the Midwinter Personnel Conference, 1949. 47 pp. American Management Assn., 330 W. 42nd St., New York 18. 75c.

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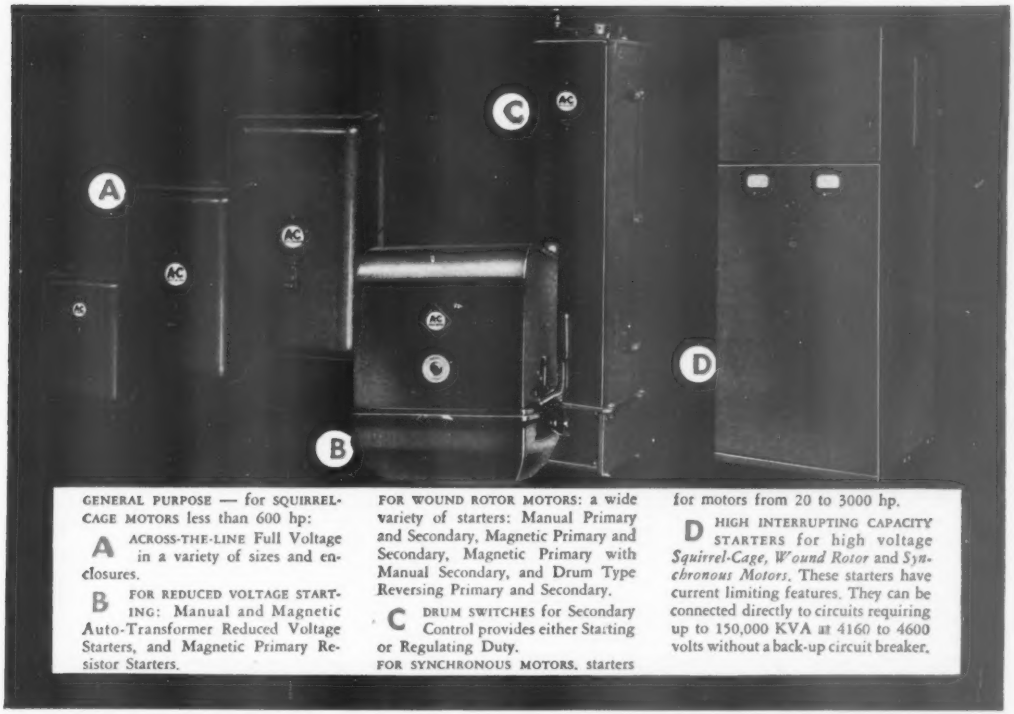

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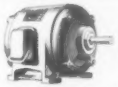

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Study No. 5: Sharon Steel and United Steelworkers of America. J. Wade Miller, Jr. National Planning Assn., 800 21st St., N. W., Washington 6. 60 pp. $1; $12.50 for set of 15 case studies.

MEASUREMENT OF THE EFFECTIVENESS OF THE PRODUCTIVE UNIT. Sir Ewart Smith, M.A., M.I. Mech.E., and Dr. R. Beeching, B.Sc., Ph.D. 4th report on 1948-49 Winter Proceedings. British Institute of Management, 17 Hill St., London W1. 35 pp. Charts, figures, appendixes. 2/6.

STANDARD WELDING TERMS AND THEIR DEFINITIONS. Master chart of welding processes; process charts. Booklet contains 50 pages, with drawings, diagrams of welding cycles. $1. Charts come in sets of five, 35¢ per set; if purchased with booklet, $1.25 for both. American Welding Society, 33 W. 39th St., New York 18.

THIRD REPORT TO CONGRESS OF THE ECONOMIC COOPERATION ADMINISTRATION. For the quarter ended Dec. 31, 1948. Supt. of Documents, U. S. Govt. Printing Office, Washington 24. 159 pp. Photographs, tables, charts, graphs; appendixes A through E. 40¢.

A CODE OF MANAGEMENT PRACTICE RELATING TO THE STATUS OF THE FOREMAN. Suggestions arising from the work of a management study group. Institute of Industrial Supervisors and Industrial Administration Group of the Students' Union of the Birmingham Central Technical College. The Secretary, Industrial Administration Group, Birmingham Central Technical College, Birmingham, England. 19 pp. 50¢.

PROCEEDINGS: FIRST ANNUAL CONFERENCE, COUNCIL OF PROFIT SHARING INDUSTRIES. Chicago, Nov. 8-9, 1948. Council of Profit Sharing Industries, First National Tower, Akron 8, O. 124 pp. $1.50.

ALUMINUM STRUCTURAL HANDBOOK. Reynolds Metals Co., 2500 S. 3rd St., Louisville 1, Ky. Photographs, sketches, diagrams, tables, charts, indexes. No charge when requested on company letterhead.

PAPERS PRESENTED AT THE FIRST SHORT COURSE ON INDUSTRIAL PACKAGING AND MATERIALS HANDLING, Chicago, Oct. 4-7, 1948. Univ. of Ill., Engineering Experiment Station, Circular Series No. 56, in cooperation with The Society of Industrial Packaging and Materials Handling Engineers. Univ. of Ill., Urbana, Ill. 248 pp. Photographs, sketches, forms. $1.

SAFE SPEEDS FOR GRINDING WHEELS. Established rules for efficient operation. Grinding Wheel Institute, Box 64, Greendale, Mass. 17 pp. Tables, graphs, charts. No charge.

PROCEDURE FOR PROCEDURES. Joseph S. Covell. Joseph S. Covell & Associates, Management and Systems Consultants, Inquirer Bldg., Philadelphia 30. 11 pp. Tables. $1.

BRAKE SHOE YARDSTICKS. Wm. B. Given, Jr., president, American Brake Shoe Co. 26 pp. Cartoons. American Brake Shoe Co., 230 Park Ave., N. Y.

"THE FACTS OF LIFE" ON AIR & HYDRAULIC DEVICES. Logansport Machine Co., Inc., Logansport, Ind. 18 pp. Diagrams. No charge.

NEW INDUSTRY COMES TO THE SOUTH. N.P.A. Committee of the South, Report No. 1. National Planning Assn., 800 21st St., N.W., Washington 6. 32 pp. $1.

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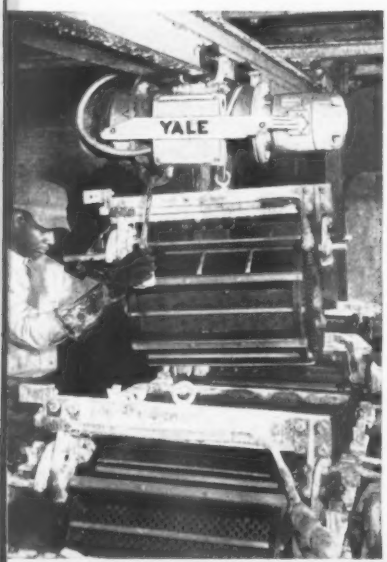

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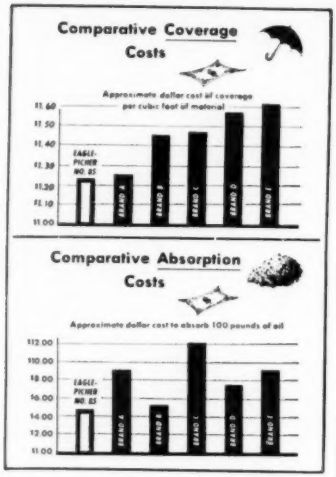

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HOW TO USE KODAGRAPH REPRODUCTION MATERIALS. Industrial Photographic Div., Eastman Kodak Co., 343 State St., Rochester 4, N. Y. 72 pp. Photographs, drawings, tables. 50¢.

THE HIDDEN PAYROLL—NON-WAGE LABOR COSTS OF DOING BUSINESS. Research Study. Economic Research Dept., Chamber of Commerce of the U. S. A., Washington 6. 32 pp. Tables, graphs, appendixes A, B, bibliography. Single copies, 50¢; lower prices for quantity orders.

APPLICATION OF STATISTICS TO THE SCIENCE OF MANAGEMENT. J. M. Juran, chairman, dept. of administrative engineering, N. Y. Univ. Bur. of Public Information, N. Y. Univ., College of Engineering, New York 53. 4 pp. 10¢.

ON THE CALENDAR

JULY

5-Aug. 13, The Society of Industrial Designers, Product Design Seminar; Lehigh University. E. M. Ramberg, Lehigh University, Bethlehem, Pa.

6-14, Course in Quality Control by Statistical Methods; Purdue University. Prof. Irving W. Burr, Dept. of Mathematics, Lafayette, Ind.

26-29, Silver Bay Conference on Industrial Relations, 31st Annual Conference. Silver Bay-on-Lake George, N. Y. William F. Meyer, Executive Secretary, 347 Madison Ave., New York.

AUGUST

9-12, 2nd Annual Western Packaging Exposition; San Francisco Civic Auditorium. Kenneth K. Dean, General Chairman, 759 Monadnock Bldg., San Francisco 5.

22-26, National Association of Power Engineers, Inc., 48th National Power Show and Convention; Hotel Sherman, Chicago. John C. Tooby, Exhibit Manager, 176 W. Adams St., Chicago 3.

23-26, American Institute of Electrical Engineers, Pacific Coast General Meeting; Fairmont Hotel, San Francisco. H. H. Henline, Secretary, 29 W. 39th St., New York 18.

SEPTEMBER

12-16, The Instrument Society of America, 4th National Exhibit; Municipal Auditorium, St. Louis, Mo. Richard Rimbach, Executive Secretary, 1117 Wolfendale St., Pittsburgh 12.

12-16, National Recreation Association, 31st National Recreation Congress; Municipal Auditorium, New Orleans. Thomas E. Rivers, Secretary, 315 4th Ave., New York 10.

14-16, Porcelain Enamel Institute, 11th Annual Forum; Ohio State University, Columbus, O. Edward Mackasek, Managing Director, 1010 Vermont Ave. N. W., Washington 5, D. C.

18-23, American Chemical Society, 116th National Meeting; Atlantic City, N. J. Alden H. Emery, Executive Secretary, 1155 16th St. N. W., Washington 6, D. C.

19-23, Illuminating Engineering Society National Technical Conference; French Lick Springs Hotel, French Lick, Ind. A. D. Hinckley, Executive Secretary, 51 Madison Ave., New York.

21-23, The National Association of Foremen, 26th Annual Convention; Statler Hotel, Detroit. J. E. Bathurst, 321 W. 1st St., Dayton 2.

26-28, American Management Association, Personnel Conference; Waldorf Astoria, New York. E. O. Malott, Division Manager, 330 W. 42nd St., New York 18.

28-30, American Society of Mechanical Engineers, Fall Meeting; Lawrence Hotel, Erie, Pa. Ernest Hartford, Executive Assistant Secretary, 29 W 39th St., New York 18.

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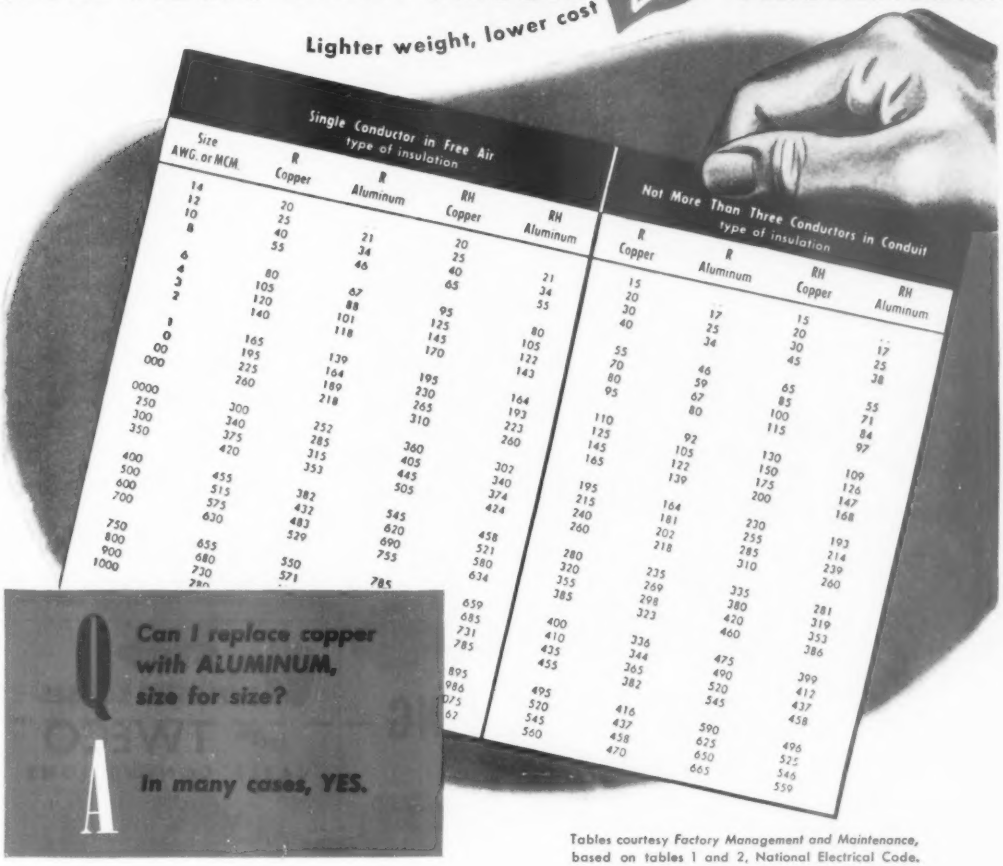

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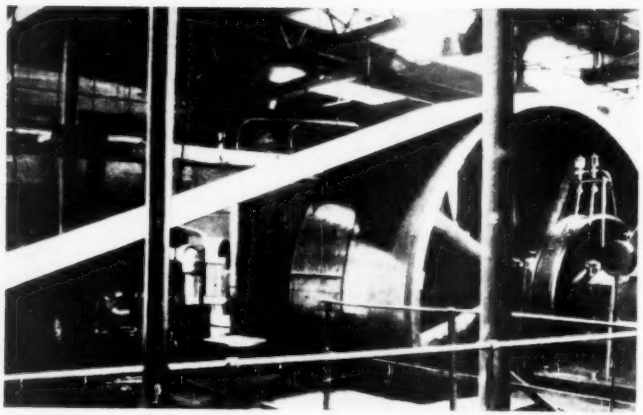

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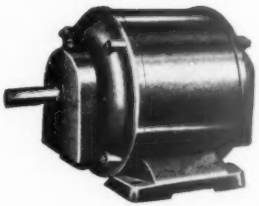

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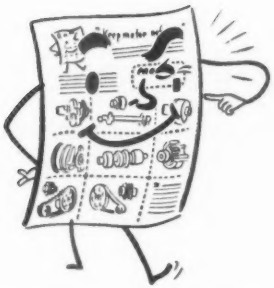

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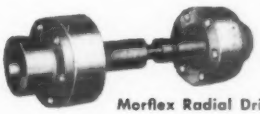

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Morflex Drive Shafts

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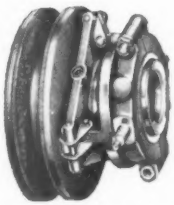

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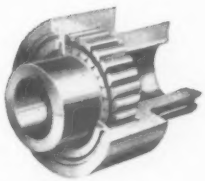

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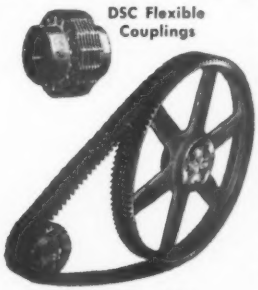

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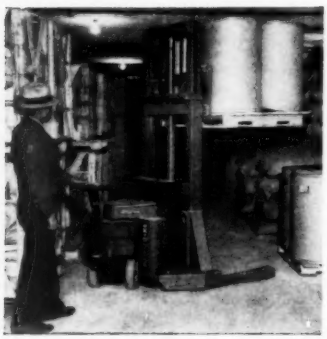

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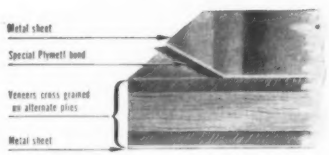

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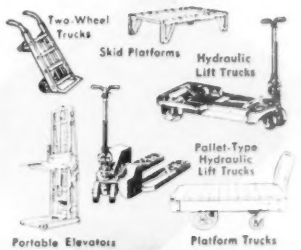

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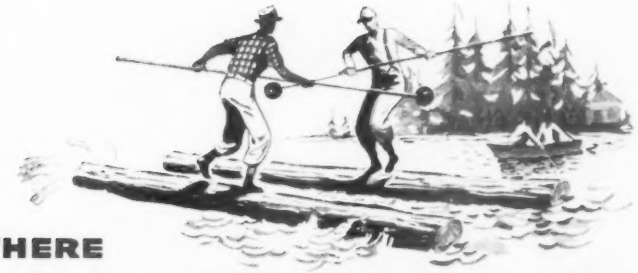

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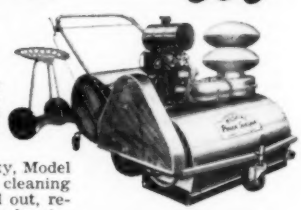

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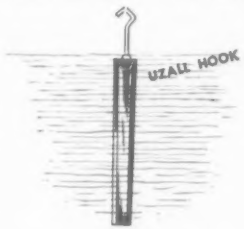

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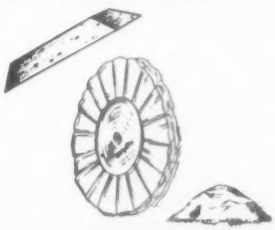

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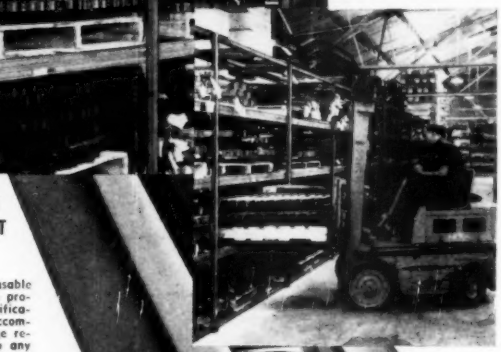

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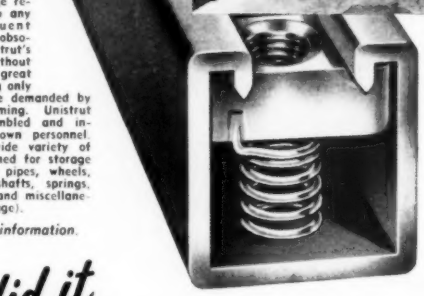

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JOINTS, EXPANSION—"Free-Flexing" and "Controlled-Flexing" corrugated type in copper and stainless steel. Bul. EJ-49. Pressure tables, ratings, structural data; photographs; descriptions. Chicago Metal Hose Corp.

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LUBRICATION—"Studies in Centralized Lubrication." Description of system, case histories of different installations. Sketches. The Farval Corp.

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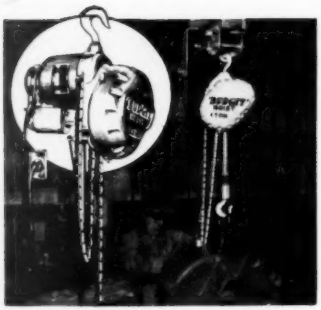

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curacy data, flow graphs for various sizes of pipes, instruction on computation. Layne & Bowler, Inc.

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OVEN, ARMATURE-BAKING, INFRA-RED—for drying transformer, armature, stator, other windings. Fits over installed motors; equipped with automatic timer. Description, design features, operating principles; specifications; exterior, interior views. The Miskella Infra-Red Co.

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PAINT—called Barrelled Sunlight. 25-page booklet, "Engineered Painting: The Right Paint in the Right Place at the Least Cost." Lighting with paint, discussion of light intensities, recommended levels of industrial illumination, use of color for different purposes. Sketches, photographs. U. S. Gutta Percha Paint Co.

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PLIERS, FLEXIBLE-JAW—called New Twist. Construction details, dimensions, applications; drawings. Industrial Products Co.

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POWER INSULATORS, SUSPENSION HARDWARE—for power transmission, distribution lines, stations. Photographs, descriptions, ratings, dimensions, diagrams, applications for different types. 30-page Handylog. Locke, Inc.

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PROTECTIVE COATINGS — corrosion-resistant, called Perma-Skin. Description, characteristics, applications of different types. Dennis Chemical Co.

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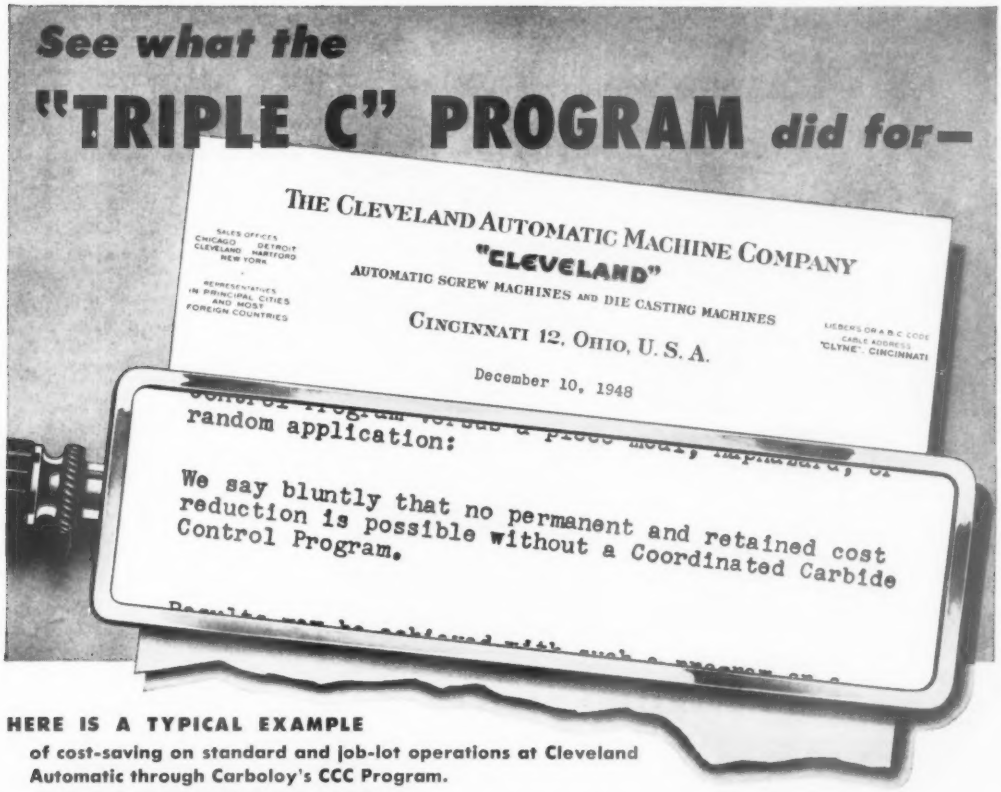
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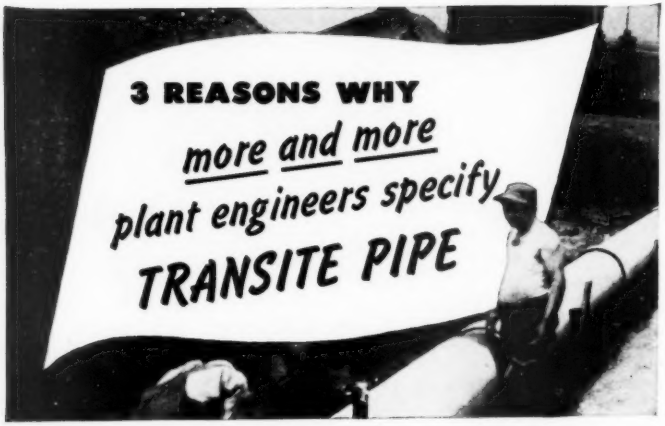

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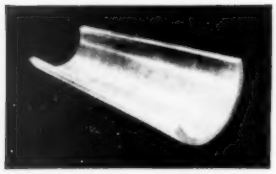

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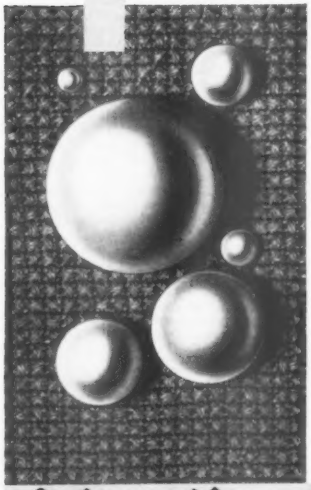

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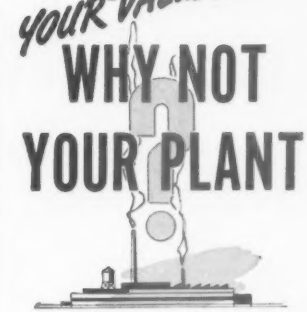

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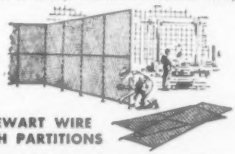

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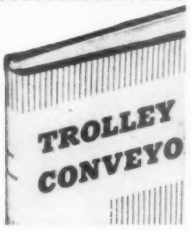

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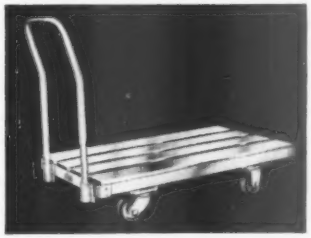
(*Continued from page 216*)



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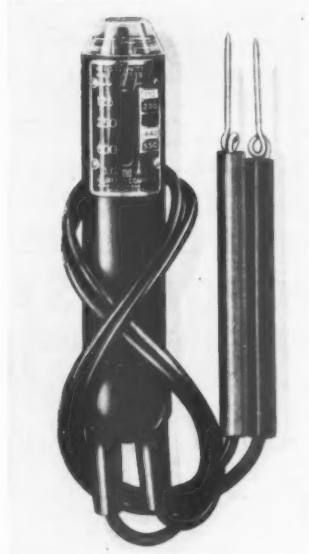

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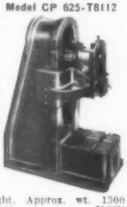

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Improve Surface Finishes
Increase Tool and Die Life

with
PANGBORN
HYDRO-FINISH

What is Pangborn Hydro-Finish? It's the new, versatile impact blasting process that uses a fine mesh abrasive suspended in water, yet holds tolerances of the work to .0001 inches.

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BLAST CLEANS CHEAPER
with the right equipment for every job

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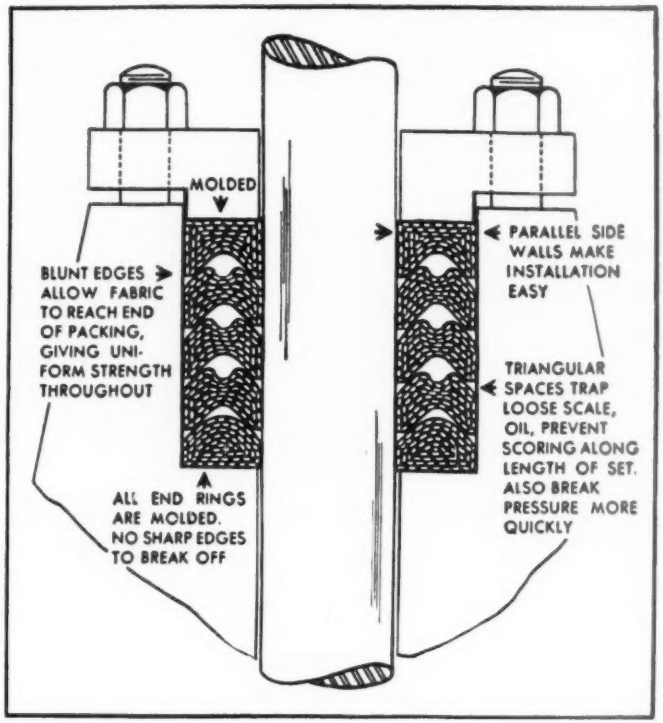
BLUNT EDGES—Give more efficient shape; allow fabric to reach end of packing, providing uniform strength throughout. In conventional packing (feather-edge design) fabric cannot be forced into sharp edge, leaving unprotected soft-rubber end to cause curling and chipping.

TRIANGULAR SPACES—Blunt edges provide triangular spaces for trapping loose scale, oil, etc. Result is lower coefficient of friction, less power required, and scaling does not score entire length of packing set.

PRESSURE BREAK—The triangular space of each ring breaks the pressure more quickly than ordinary types without this feature. With U. S. Rubber Matchless Packing design, automatic action is faster, more effective.

MOLDED END RINGS—Tests show the female ring and the one next to it take 70% of the pressure on the set. In Matchless, *all* rings are molded, are of proper density, and have no sharp edges to break off, as on end rings cut from slab.

EASY TO INSTALL—Matchless Packing has parallel side walls, while conventional packings are made with varying degrees of wall flare. Matchless rings slide easily into stuffing box; the flare type requires considerable effort and time.


MOLDED
BLUNT EDGES ALLOW FABRIC TO REACH END OF PACKING, GIVING UNIFORM STRENGTH THROUGHOUT
ALL END RINGS ARE MOLDED. NO SHARP EDGES TO BREAK OFF
PARALLEL SIDE WALLS MAKE INSTALLATION EASY
TRIANGULAR SPACES TRAP LOOSE SCALE, OIL, PREVENT SCORING ALONG LENGTH OF SET. ALSO BREAK PRESSURE MORE QUICKLY

Matchless Packing is installed as original equipment by some of the largest manufacturers of hydraulic presses, rotary oil well drilling rigs, presses, rams, triplex pumps and outside packed pumps.

The self-adjusting, automatic action of Matchless results in reduced wear on rods and plungers, cuts down packing costs and time out for replacement. There is a precisely measured mold for every standard size, and many intermediate sizes can be made from existing equipment. For more information about Matchless, write Mechanical Goods Division, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

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SERVING THROUGH SCIENCE

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above
• Size 2 plug-in starter unit

right
• Disconnect operator handle

NOW ... *take full advantage of Control Center convenience, safety and economy . . . Square D "PLUG-IN" centers are new from the ground up, with all basic features plus . . .*

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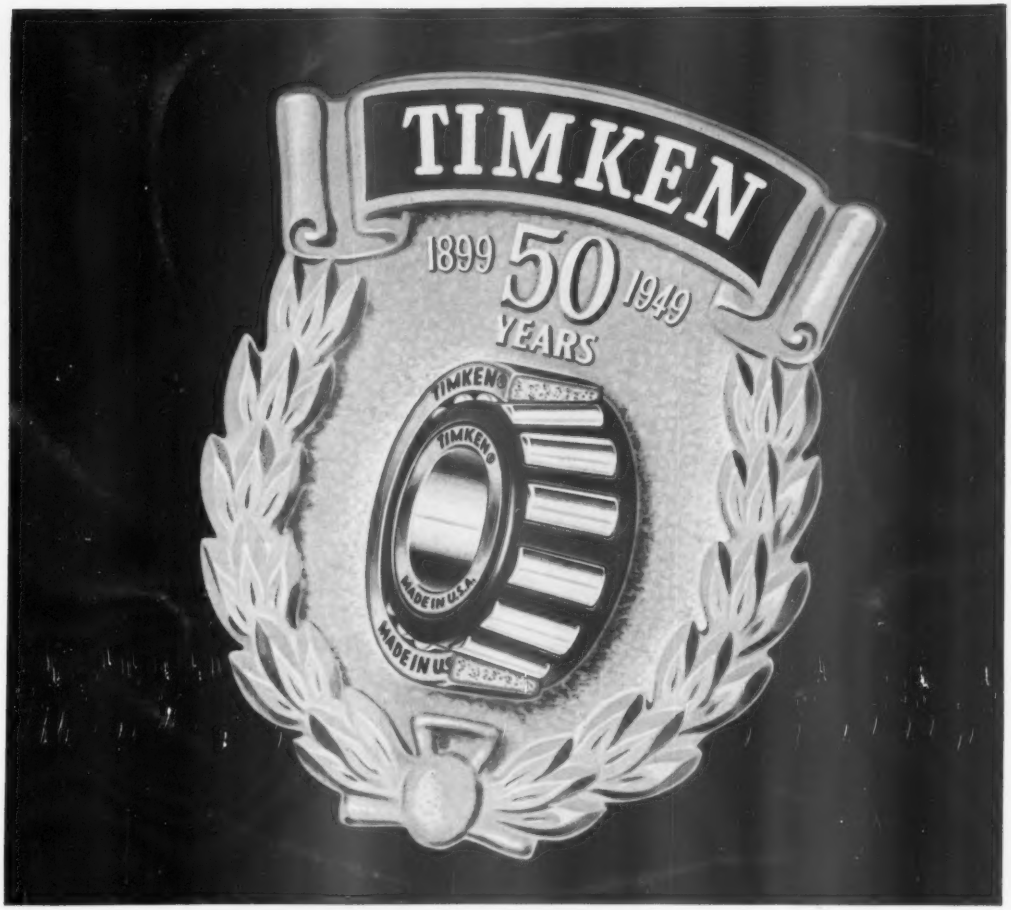

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